



Models 722, 727, 728, 729
Forma -40C Lab Freezer

Operating and Maintenance Manual
Manual No: 7020722 Rev. 5

Read This Instruction Manual.

Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance.

CAUTION! All internal adjustments and maintenance must be performed by qualified service personnel.

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Model	Capacity in Cubic Feet	Voltage
722	13	120
727	13	230
728	17	120
729	17	230

Packing List

Part Number	Description	Quantity
34040	Key Ring	1 (2 for double door units)
122005	Key	2 (4 for double door units)
380520	Neoprene Cap	2
510016	1/4-20 x 5-1/2" Bolt	2
402058	Vacu-Key	1
195763	Retaining Clip	1
370563	Remote Alarm Connector	1

MANUAL NUMBER 7020722

7	23939	5/29/07	Added "Adjust LN ₂ tank pressure relief valve to 30 PSI max blow-off"	ccs
--	24100	5/16/07	Clarified battery switch to Standby mode, with symbol	ccs
4	23859/FR-1940	1/3/07	Clarified BUS install (probe/solenoid harness) instructions	ccs
3	23700/FR-1919	10/09/06	Updated safety temp specs (from 5° - 40°C to 5° - 43°C)	ccs
2	23170	2/9/06	Remote alarm connector is customer installed	aks
--	22930	2/9/06	WEEE Directive	aks
1	22895	8/16/05	Remove rotalock valve from compressor	aks
0	--	7/14/05	Release 3	aks
REV	ECR/ECN	DATE	DESCRIPTION	By



Important operating and/or maintenance instructions. Read the accompanying text carefully.



Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.



Hot surface(s) present which may cause burns to unprotected skin or to materials which may be damaged by elevated temperatures



Extreme temperature hazards, hot or cold. Use special handling equipment or wear special, protective clothing.



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- √ Always use the proper protective equipment (clothing, gloves, goggles, etc.)
- √ Always dissipate extreme cold or heat and wear protective clothing.
- √ Always follow good hygiene practices.
- √ Each individual is responsible for his or her own safety.

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Regardless of your needs, our professional telephone technicians are available to assist you Monday through Friday from 8:00 a.m. to 6:00 p.m. Eastern Time. Please contact us by telephone or fax. If you wish to write, our mailing address is:

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Section 1 - Installation and Start-up

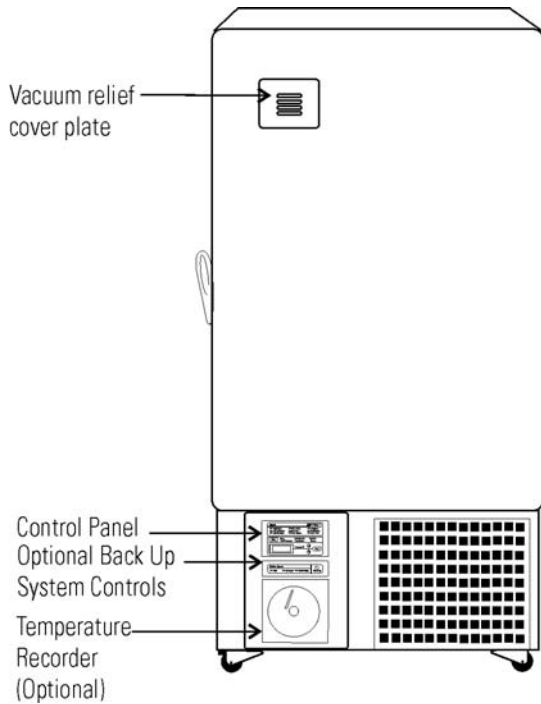


Figure 1-1
Model 700 Series -40C Front

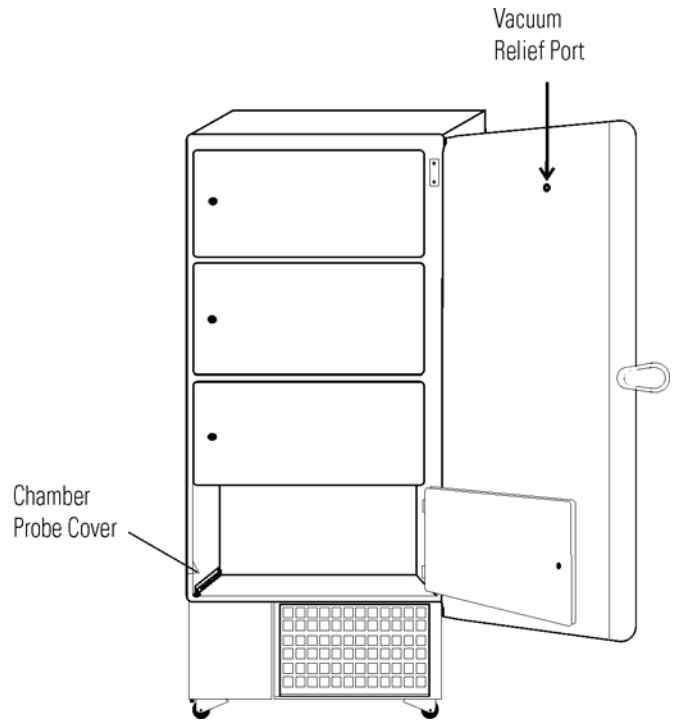


Figure 1-4
Vacuum Relief and Probe Cover Location

1.1 Freezer Components

Figure 1-1

- Control Panel - keypad, displays and indicators.
- BUS (Optional Back Up System) panel.
- Optional temperature recorder - 7 day, one pen or Datalogger.
- Vacuum relief port cover plate.

Figure 1-2

- Remote alarm contacts.
- Power Inlet for power cord connection.
- Optional BUS connections for probe and solenoid.
- Power Switch (mains disconnect).

Figures 1-3 and 1-4

- Vacuum relief port - pressure equalization port.
- Probe cover - houses control, optional recorder, datalogger or 1535 alarm probes.

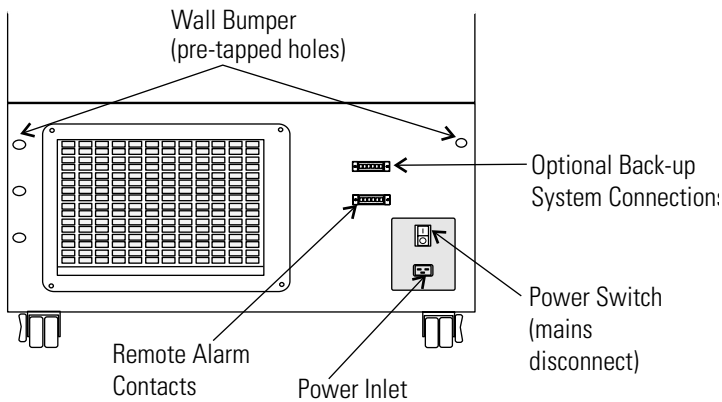


Figure 1-2
Model 700 Series -40C Rear

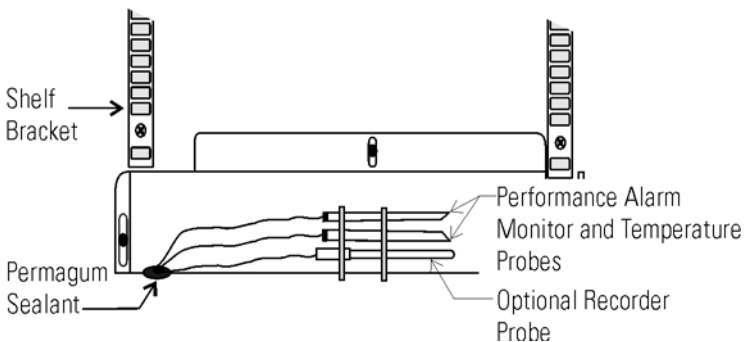


Figure 1-3
Chamber Probe(s)

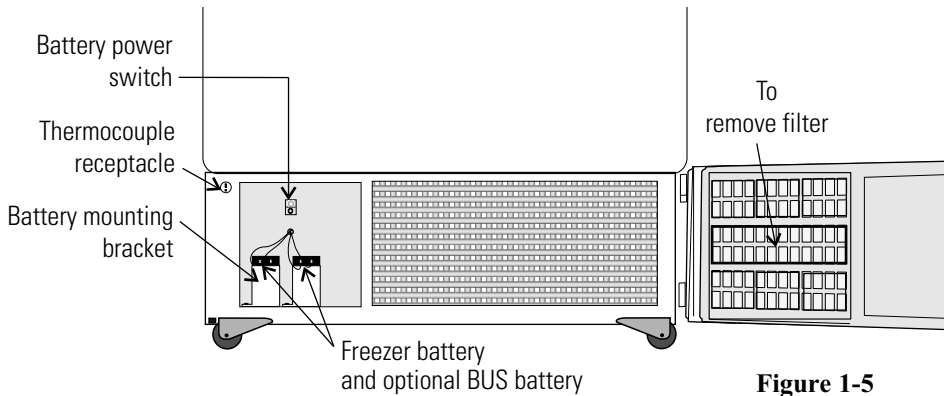


Figure 1-5

- Battery mounting bracket(s)
- Battery power switch (freezer and BUS)
- Freezer battery
- Optional BUS battery
- Freezer filter location

**Figure 1-5
Battery(s) location and Switch**

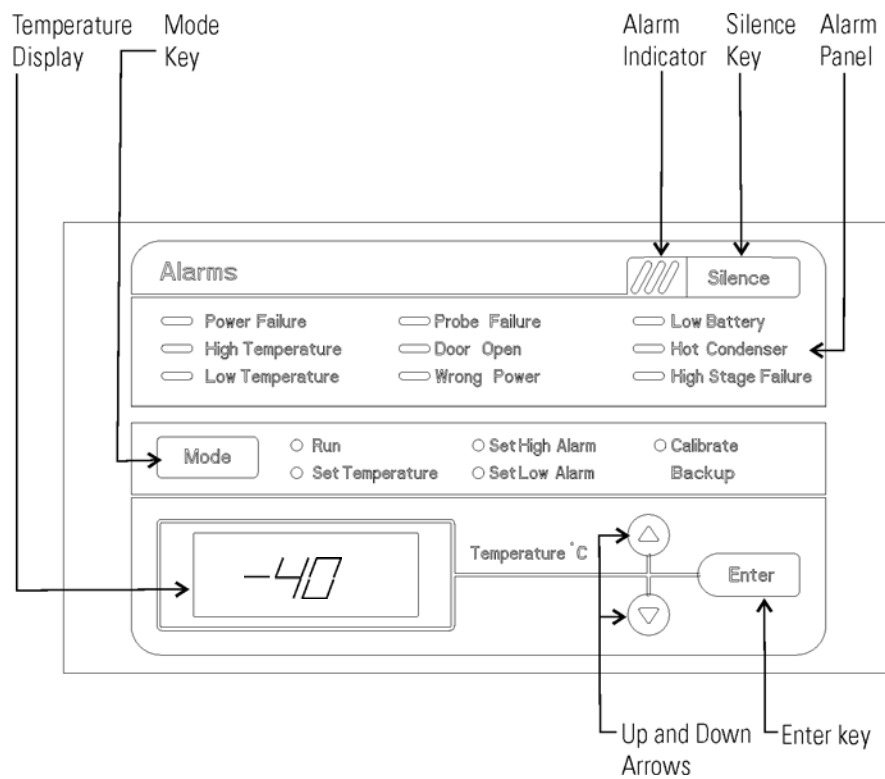


Figure 1-6, Control Panel

**1.2 Control Panel Keys, Displays and Indicators
(See Figure 1-6)**

1. **Temperature Display** - Displays temperature in degrees Celsius.
2. **Mode Select Switch** - Used to select Run, Set Temperature, Set High Alarm, Set Low Alarm, Calibrate, Backup.
3. **Alarm Indicator** - Light pulses on/off during an alarm condition of the cabinet.
4. **Silence** - Silences the audible alarm.
5. **Alarm Panel** - indicates the current alarm condition.
6. **Up and Down Arrows** - Increases or decreases values, toggles between choices.
7. **Enter** - Stores the value into memory.

1.3 Operation of the Keypad

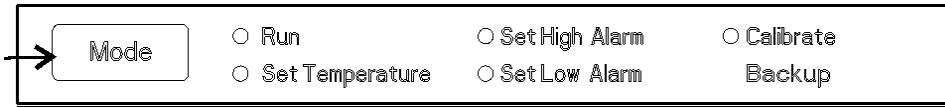
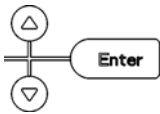


Figure 1-7



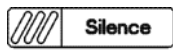
The Model 700 Series freezer has five basic modes which allow freezer setup and operation. Press the Mode key to scroll through the mode selections.



Up Arrow: Increases or toggles the parameter value.

Enter: Must press Enter key to save to memory all changed values.

Down Arrow: Decreases or toggles the parameter value.



Silence Key: Press to silence the audible alarm. See Section 4 for alarm ringback times.

1.4 Installing the Freezer



If tipped more than 45°, allow the unit to sit upright for 24 hours before start up.

To remove the freezer from the pallet, use the 7/16" wrench to remove all the bolts securing the shipping bracket to the pallet.

Remove the shipping bracket. Remove the ramp boards from the pallet and place the slotted end over the ramp brackets on the pallet. The support blocks on the ramps will be facing down. Before moving the freezer, make sure the casters are unlocked and moving freely. Align the caster with the ramp boards. Use adequate personnel to roll the freezer off the pallet.

The freezer can be easily pushed to the desired approved location, described in Section 1.4.a. If necessary, the doors and lower front panel may be opened to move the unit through tight openings. When the freezer is in position, set the front caster brakes.



The freezer must not be moved with the product load inside.



For proper ventilation and airflow, a minimum clearance of 5" at the rear and top and a clearance of 8" on the side of the freezer is required. Allow adequate space in the front of the freezer for door opening.

a. Choosing the Location

Locate the freezer on a firm, level surface in an area with an ambient temperature between 18°C and 32°C. Provide ample room to reach the mains disconnect switch (power switch) located on the rear of the freezer.

b. Installing the Wall Bumpers

The parts bag, located inside the cabinet, contains the following parts.

Qty	Stock #	Description	Purpose
2	510016	1/4-20 x 5-1/2" Bolt	Wall Bumper
2	380520	Neoprene Cap	Cap Protector

Install the bolts into the pre-tapped holes on the back of the compressor section. Install a neoprene cap on each bolt. Refer to Figure 1-2 for the locations of the pre-tapped holes.

c. Installing the Shelves

Install the shelf clips into the shelf pilasters (front and back) at the desired shelf level. Install the shelves in the cabinet onto the clips.

d. Remote Alarm Contacts

See Figure 1-2 for the location of the remote alarm contacts. The remote alarm connector is located in the parts bag provided with the manual. It must be installed if connecting the freezer to an alarm system. After installing the wiring from the alarm system to the connector, install the connector to the freezer microboard and secure with the two screws provided. The remote alarm provides a NO (normally open) output, a NC (normally closed) output and COM (common). The contacts will trip on a power outage, high temperature alarm or low temperature alarm. Figure 1-8 shows the remote contacts in alarm state.

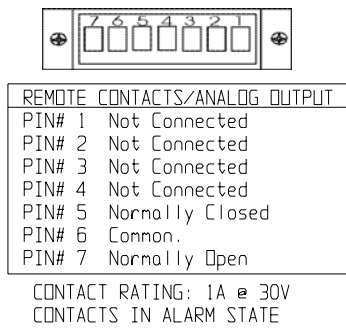


Figure 1-8

IMPORTANT USER INFORMATION

Caution! Stored product should be protected by an activated alarm system capable of initiating a timely response 24 hours/day. Alarms provide interconnect for centralized monitoring.

e. Attaching the Power Cord

Insert the power cord into the power inlet module. Place the retaining bracket (P/N 195763) over the connector. Tighten retaining screws to secure.

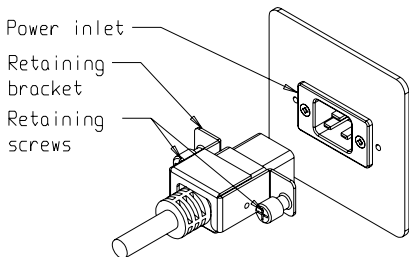


Figure 1-9

f. Connecting the Unit to Electrical Power

See the serial tag on the side of the unit for electrical specifications or refer to the electrical schematics in this manual.

The freezer should be operated on a dedicated grounded service. Check the voltage rating on the serial tag of the unit and compare it with the outlet voltage. Then, with the power switch turned off, plug the line cord into the wall outlet.

First, turn on the freezer power switch. Then open the lower front door by grasping the bottom left corner. Locate the battery switch (Figure 1-5) and turn it to Standby mode (⏻). During initial freezer start-up, the system battery may require charging and the Low Battery indicator may illuminate.



Ensure the battery switch is turned to Standby mode (⏻). The rechargeable batteries require 36 hours to charge at initial start-up. A “Low Battery” alarm may occur until the batteries are fully charged. Should a power failure occur during the initial start-up period, the electronics will have limited operation.

1.5 Freezer Start-Up

With the freezer properly installed and connected to power, system set points can be entered. The following set points can be entered in Settings mode: Control temperature, high temperature alarm set point, low temperature alarm set point, and (optional) BUS set point. Default settings are shown in the table

Control Set Point	-40°C
High Temperature Alarm	-30°C
Low Temperature Alarm	-50°C
Optional BUS Set Point	-30°C

below.

If the set point is changed and the low temperature and high temperature alarms are set 10° from the set point, the alarm set points will be adjusted automatically to maintain a distance of at least 10° from set point.

a. Setting the Operating Temperature

The Model 700 Series -40°C freezers have an operating temperature range of -10°C to -40°C. The freezer is shipped from the factory with a temperature set point of -40°C. To change the operating temperature set point:

1. Press the Mode key until the Set Temperature indicator lights.
2. Press the up/down arrow key until the desired temperature set point is displayed.
3. Press Enter to save the set point.
4. Press the Mode key until the Run indicator lights for Run mode

If no keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

b. Setting the High Temperature Alarm

The high temperature alarm will activate an audible/visual warning when the freezer chamber temperature has reached or exceeded the high temperature alarm set point.

To set the high temperature alarm set point:

1. Press the Mode key until the Set High Alarm indicator lights.
2. Press the up or down arrow key until the desired high temperature alarm set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

Note: The high alarm set point must be set at least 5°C from the control set point.

At initial start-up, the high temperature alarm is disabled until the cabinet reaches set point or 12 hours elapse.

c. Setting the Low Temperature Alarm

The low temperature alarm will activate an audible/visual warning when the freezer chamber temperature has reached or decrease below the low temperature alarm set point.

To set the low temperature alarm set point:

1. Press the Mode key until the Set Low Alarm indicator lights.
2. Press the up or down arrow key until the desired low temperature alarm set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

Note: The low alarm set point must be set at least 5°C from the control set point..

1.6 Run Mode

Run mode is the default mode for the freezer. Run mode will display the cabinet temperature on the temperature display under normal operating conditions. In addition, the Run mode allows display of the high stage heat exchange temperature.

This information is scrolled by pressing the up or down arrow keys. The display will return to the operating temperature in 10 seconds if no keys are pressed.

Section 2 - Calibrate

2.1 Calibrate Mode

Once the freezer has stabilized, the control probe may need to be calibrated. Calibration frequency is dependent on use, ambient conditions and accuracy required. A good laboratory practice would require at least an annual calibration check. On new installations, all parameters should be checked after the stabilization period.



Before making any calibration or adjustments to the unit, it is imperative that all reference instruments be properly calibrated.

a. Calibrating the Control Probe

Plug a type T thermocouple reader into the receptacle located inside the lower door (see Figure 1-5). Compare the control temperature set point to the temperature of the measuring device.

1. Press the Mode key until the Calibrate indicator lights.
2. Press up/down arrow to match the display to calibrated instrument.
3. Press Enter to store calibration.
4. Press the Mode key to return to Run mode.

Temperature Stabilization Periods

Startup - Allow 12 hours for the temperature in the cabinet to stabilize before proceeding.

Already Operating - Allow at least 2 hours after the display reaches set point for temperature to stabilize before proceeding.

During calibration, the temperature display will not be available.

If no keys are pressed for approximately five minutes while in calibration mode, the system will reset to Run mode.

Section 3 - Alarms

3.1 Alarms

The Model 700 Series -40C freezer alarms are displayed on the freezer control panel. When an alarm is active, the indicator next to the alarm description will light and there will be an audible alarm. Press the Silence key to disable the audible alarm for the ringback period. The visual alarm will continue until the freezer returns to a normal condition. The alarms are momentary alarms only. When an alarm condition occurs and then returns to normal, the freezer automatically clears the alarm condition.

Description	Delay	Ringback	Relay
Power Failure	1 min.	15 min.	Yes
High Temperature Alarm	1 min.	15 min.	Yes
Low Temperature Alarm	1 min.	15 min.	Yes
Probe Failure - see Section 3.2	1 min.	15 min.	No
Door Open	1 min.	15 min.	No
Wrong Power	0 min.	none	Yes
Low Battery*	1 min.	12 hours	No
Hot Condenser	1 min.	none	No

All alarm delays and ringback times are ± 30 seconds.

* The automatic battery test runs 12 hours after initial start-up, then every 12 hours thereafter.

3.2 Wrong Power

The Wrong Power alarm occurs when incorrect voltage is applied to the freezer. If a 230V freezer is connected to a 120V power source or a 120V freezer is connected to a 230V power source, the electronics will detect that the "Wrong Power" has been applied. Under this condition, the fans and compressors will not turn on and an audible and visual alarm will occur. This alarm may also occur if the battery switch is turned to Standby mode (⏻) prior to applying power to the freezer. The audible and visual alarms will remain until the freezer is connected to the correct power source. The audible alarm cannot be silenced under this condition.

3.3 Probe Failure Alarm

The microprocessor in Model 700 Series freezers continually scans all probes including the control probe, heat exchanger probe and condenser probe to ensure that they are operating properly. Should an error be detected, the "Probe Failure" alarm will occur as described in Section 3.1 above. If an error is detected with the control probe, the high and low stage compressors will run continuously. As a result, the cabinet temperature will decrease until it reaches the lowest temperature that the refrigeration system can maintain. If an error is detected with the heat exchanger probe, the freezer will cycle properly at its temperature set point using a 5 minute step start between the high and low stage compressors. If an error is detected with the condenser probe, there is no impact on the performance of the freezer; however, the hot condenser alarm may also occur. Contact the Technical Services department (1-888-213-1790) or your local distributor.

3.4 Voltage Compensation Alarm

In addition to the alarms listed above, another condition is detected by the controls that will result in an audible and visual alarm. If the freezer is compensating for high or low line voltage, the system will measure the compensated AC voltage. If the voltage is incorrect, the unit will stop attempting to compensate, and the compressor will run on direct line voltage. Under this condition, there will be a visual and audible alarm that can be silenced with a ringback period of fifteen minutes. This alarm condition is unlikely to occur, and as such, there is no LED alarm indicator for this condition.

Section 4 - Maintenance

4.1 Cleaning the Cabinet Exterior



Avoid the excessive use of water around the control area due to the risk of electrical shock. Damage to the controls may also result.

Wipe down the freezer exterior using soap and water and a general use laboratory disinfectant. Rinse thoroughly with clean water and dry with a soft cloth.

4.2 Cleaning the Air Filter (minimum of four times a year)

1. Open the front lower door by grasping the bottom left corner.
2. Locate the grille on the door. See Figure 1-5. Grasp the middle of the grille material and gently pull out to remove.
3. Wash the filter material using water and a mild detergent.
4. Dry by pressing between two towels.
5. Install the filter back into the grille and attach the grille.

Depending upon environmental conditions, the filter may need to be cleaned or replaced more frequently. If the filter becomes torn or excessively dirty, a replacement can be purchased from Thermo. See the exploded parts list, Section 7, for filter part number. A filter kit (set of 5) is also available.

4.3 Cleaning the Condenser (minimum yearly)

1. Open the front lower door by grasping the bottom left corner. See Figure 1-5.
2. Using a vacuum cleaner, exercising care to not damage the condenser fins, clean the condenser.

Depending upon environmental conditions, the condenser may need to be cleaned more frequently.



Do not use liquids that are corrosive to stainless steel or the brazing material (copper or nickel).

4.4 Defrosting the Chamber

1. Remove all product and place it in another freezer.
2. Turn the unit off and disconnect it from the power source.
3. Turn off the battery switch (O). See Figure 4-7.
4. Open all of the doors and place towels on the chamber floor.
5. Allow the frost to melt and become loose.
6. Remove the frost with a soft cloth.
7. After defrosting is complete, clean the interior with a non-chloride detergent. Rinse thoroughly with clean water and dry with a soft cloth.
8. Plug unit in and turn power switch on.
9. Turn the battery power switch to Standby mode (C).
10. Allow the freezer to operate empty overnight before reloading the product.

4.5 Cleaning Door Gasket (minimum monthly)

Using a soft cloth, remove any frost build-up from the gasket and door(s). The door gasket may need to be cleaned more frequently if dirt or excessive frost build-up prevents the door from closing properly.

4.6 Cleaning Vacuum Relief Port (minimum monthly)

The exterior door gasket provides an excellent seal that protects product, provides an energy efficient thermal barrier to keep cold air in and room temperature air out and reduces frost build up on the inner doors.

Because the door gasket seals so well, a vacuum can be created after a door opening. Warm air enters the cabinet, cools and contracts, creating a vacuum that pulls the door in tightly against the seal.

To equalize the pressure inside the cabinet after a door opening requires 1.5-3.0 cu.ft. of ambient air to be drawn into the cabinet. The amount of air required to equalize the pressure varies depending on the cabinet size, cabinet temperature, duration of door opening, inventory volume and the temperature/humidity of the ambient air. The unit is designed with a “vacuum relief port” that allows the pressure to be equalized.

The time required to draw 1.5-3.0 cu.ft. of air into the cabinet depends on two factors,

- a) the size and number of paths available for the air to enter the cabinet, and
- b) the pressure difference between the internal cabinet and the ambient room.

Cabinets with the vacuum relief port operating normally, (i.e. vacuum relief port is not iced over) will require a minimum of 30 seconds up to a maximum of 120 seconds for the cabinet to equalize. This is also a good indication that the exterior door is well sealed.

The vacuum relief port requires routine maintenance. It will ice over unless preventive measures are taken. If the vacuum relief port becomes iced over, the freezer will take several hours to equalize pressure.

To open the door if a vacuum lock occurs:

1. Unlatch the handle of the freezer (Figure 4-1).
2. On the HINGED side of freezer (Figure 4-2), slide part number 402058 tool or a non-metallic flat object such as a ruler, tongue depressor or plastic putty knife carefully between the door gasket and door until only the end of the tool handle is showing (Figure 4-3). There will be a noticeable sound of air exchange that could last a few minutes.
3. As the air pressure equalizes, the door releases.

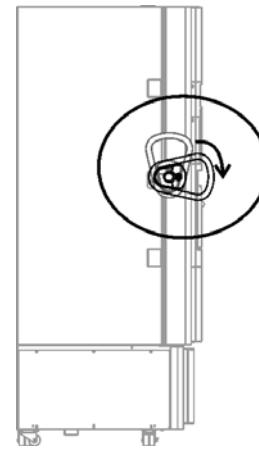


Figure 4-1



Do not leave the freezer unattended while the door is unlatched. The vacuum could release resulting in a door opening and product loss.

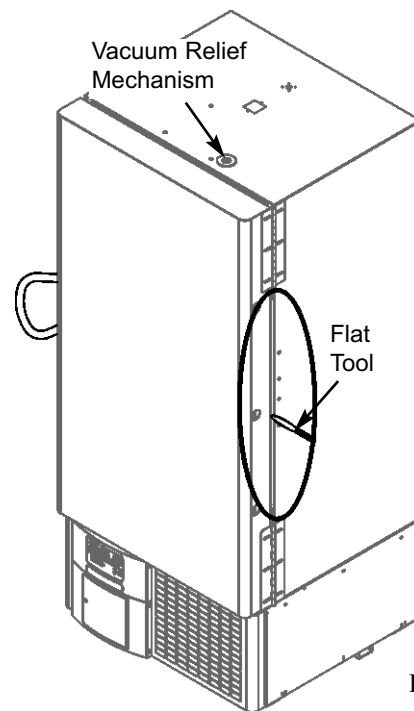


Figure 4-2

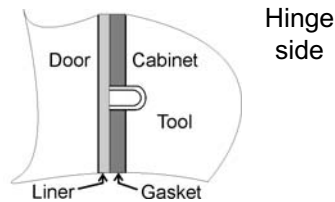


Figure 4-3

Vacuum Relief Port Maintenance

Observe the inner side of port with each door opening for frost and ice build-up. Remove any frost with a soft dry cloth. If the tube should become clogged with ice, it must be cleaned. **Make sure during cleaning that the vacuum relief tube is completely free of ice to prevent rapid ice formation.**

Other factors that can affect the performance of the vacuum relief port include: high ambient temperature, high humidity conditions and frequent door openings.

Maintenance should be performed weekly, or as needed.

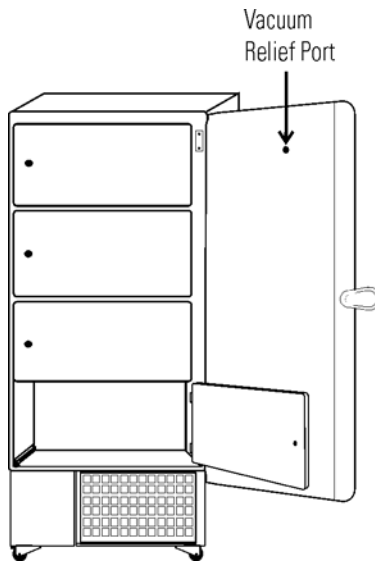


Figure 4-4

Failure to maintain the vacuum relief port may result in excessive ice build up inside the tube, clogging the port, and inability to open the door. The vacuum relief port may need to be cleaned more often with frequent door openings and high humidity environments.

4.7 Replacing the Battery(s)

1. To gain access to the battery, open the lower door by grasping the bottom left corner. The battery is rectangular in shape, located on the front left corner of the compressor compartment and is secured in place by a mounting bracket.
2. Directly above the battery(s) is the battery power switch. Turn the battery power switch to the off position (O).
3. Disconnect the battery connections.
4. Remove the old battery and install the new battery.
6. Reconnect the battery (red to positive and black to negative).
7. Turn the battery power switch to Standby mode (⏻).
8. Close lower panel door.

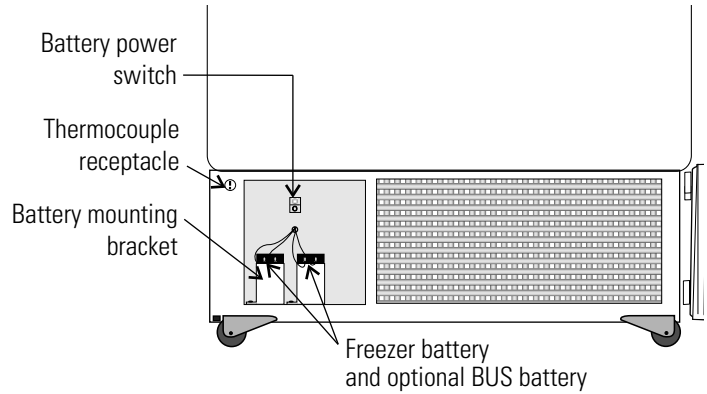


Figure 4-5



The % of charge can vary depending on the age, usage and condition of the battery. For a consistent and dependable charge, replace the battery every 2 years. Replacement batteries must be rechargeable and are available from Thermo. Refer to the parts list for stock number and description of the replacement batteries. Dispose of the used batteries in a safe manner and in accordance with good environmental practices.

4.8 Preparing the Unit for Storage

Defrost the unit as described in Section 4.4. This will prepare the unit for storage. Turn off the battery power switch (O). Turn off the freezer power switch. Disconnect power to the battery(s) and to the freezer.



If the unit has been in service, turn it off and disconnect the power cord connector before proceeding with any maintenance.

PREVENTIVE MAINTENANCE

Freezers

Your equipment has been thoroughly tested and calibrated before shipment. Regular preventive maintenance is important to keep your unit functioning properly. The operator should perform routine cleaning and maintenance on a regular basis. For maximum performance and efficiency, it is recommended that the unit be checked and calibrated periodically by a qualified service technician.

The following is a condensed list of preventive maintenance requirements. See the specified section of the instruction manual for further details.

We have qualified service technicians, using NIST traceable instruments, available in many areas. For more information on Preventive Maintenance or Extended Warranties, please contact us at the number below.

Cleaning and calibration adjustment intervals are dependent upon use, environmental conditions and accuracy required.

Tips:

- Fill an upright by starting at the bottom near the probe and add racks to one shelf at a time. Allow freezer to recover to set point between shelves.
- Fill a chest by starting at the left side near the probe. Filling with room temperature racks will result in a long pull-down time.
- Fill unit with frozen product to help overall performance; frozen water jugs, for example.
- Always make certain the vacuum relief port is free of frost and ice, to allow for timely re-entry into the freezer after a door opening.

• 401 Millcreek Road, Box 649 • Marietta, Ohio 45750 USA • 740-373-4763
• USA and Canada 888-213-1790 • Telefax: 740-373-4189 • email: services.controlenv@thermo.com/forma

Preventive Maintenance for 700 Series Freezers

Refer to Manual Section	Action	Monthly	Yearly	Every 2 Years
--	Verify ambient temperature, <90°F	<input checked="" type="checkbox"/>		
--	* Adjust door handle for firm latching, as needed	<input checked="" type="checkbox"/>		
Figure 1-4 for probe location 4.5, 4.6	Check and clean probe cover, gaskets, hinges, and vacuum relief port of ice and snow	<input checked="" type="checkbox"/>		
			<i>More frequent cleaning may be required, depending on use and environmental conditions</i>	
4.2	Check air filter. Clean or replace as needed	<input checked="" type="checkbox"/>		
1.5.f, 4.7	Check alarm back-up battery	<input checked="" type="checkbox"/>		** Replace
--	Check condenser fan motor for unusual motor noise or vibration		<input checked="" type="checkbox"/>	
2	* Verify and document calibration, at the minimum, annually		<input checked="" type="checkbox"/>	
4.3	* Clean condenser compartment and wipe off condenser		<input checked="" type="checkbox"/>	

* Qualified service technicians only

** Dispose of properly, according to all state and federal regulations

To minimize ice build-up inside of freezer:

- Locate the freezer away from drafts or heating/cooling vents
- Keep the number of door openings to a minimum
- Minimize the length of time door is open
- Make sure door latches securely after opening

Section 5 - Factory Installed Options

5.1 BUS - Back Up System (195875, 195877)

Before installation of BUS components, make sure the power to the freezer is disconnected, the battery switch is turned off (O) and the freezer has warmed to ambient temperature.

The built-in BUS (back up system) will keep the freezer chamber temperature below the critical level in the event of a power or equipment failure. If power to the freezer fails, or temperature increases to the back up alarm set point, the BUS injects liquefied gas into the chamber to keep the chamber temperature within the specified range.

The BUS operates on an internal 12-volt, rechargeable battery which is kept charged during normal operation by the integral battery charger.

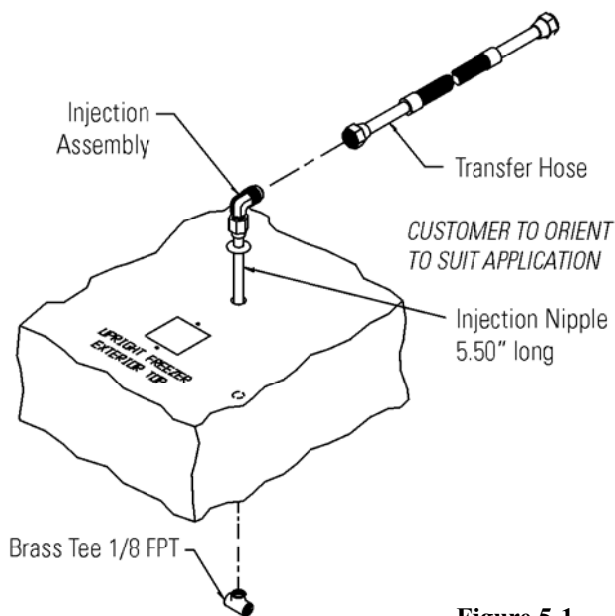


Figure 5-1

a. Installing Vent Stack, Solenoid and Injection Assembly

1. Install the injection assembly through the 1/2" pre-punched hole, directly behind the 2" vent stack hole in the center of the chamber ceiling.

Note: Cover the open end of injection assembly with tape to keep insulation from entering the nipple.

2. Slide 3/8" flatwasher over open end of nipple.
3. Insert the covered end of the injection assembly through the exterior hole.
4. Remove the tape covering from the end of the nipple and install the 1/8" NPT brass tee on the open end of the nipple. Place Permagum sealant between the brass tee and the interior top.
5. Remove the two Phillips head screws securing the metal bracket on the vent stack assembly.
6. Install the vent stack through the opening and secure it to the top of the freezer, using screws.
7. Go to the interior and seal around the end of the vent stack with Permagum.
8. Install the transfer hose connecting one end to the injection assembly, the other end to the solenoid valve. Install the solenoid valve to the supply source. The solenoid mounting bracket is not required and may be discarded.

When selecting a CO₂ supply cylinder, it must be equipped with a siphon tube.

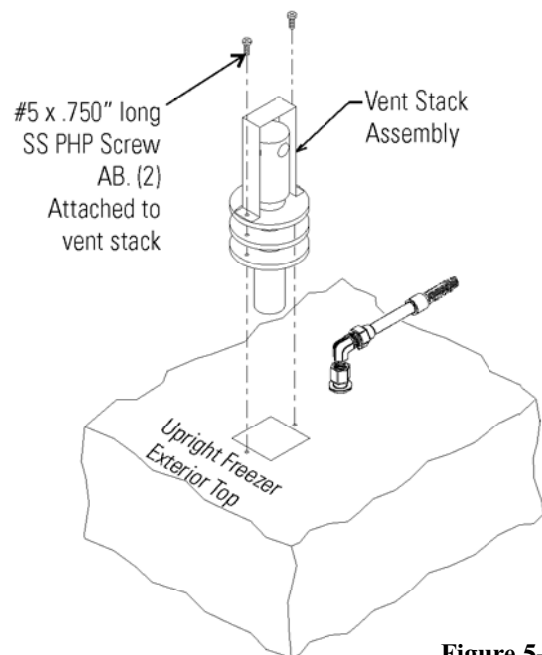


Figure 5-2

b. Installing the Temperature Probe

1. Locate the 0.500" pre-punched hole in the upper left hand back corner of the chamber ceiling. Remove the tie wrap securing the coiled probe/solenoid harness. Uncoil the probe lead and run the probe tip (approximately 12") down through 0.500" porthole (Figure 5-4).

2. As in Figure 5-3, thread the small tie wrap through the openings in the front of the bracket. Secure the probe on the back of the bracket with the tie wrap.

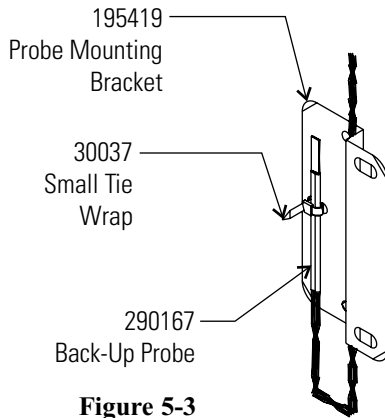


Figure 5-3

3. Tap #8-32 the two pre-punched holes located on the interior left wall of the freezer. Mount the bracket. Figure 5-4 shows the Back-Up probe mounted on the interior left side wall of the freezer.

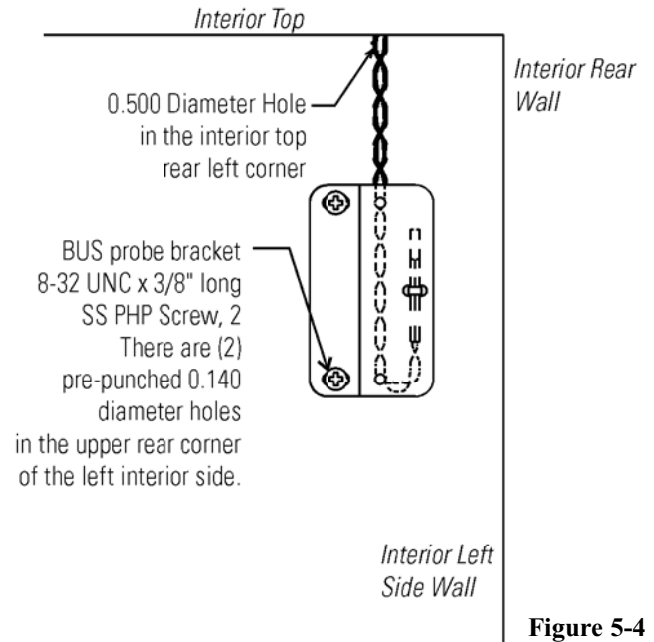


Figure 5-4

c. Connecting the Probe/Solenoid Harness

1. Remove the four screws on the freezer back panel and use them to mount the tie wrap anchors as shown in Figure 5-5. Secure the probe wire with tie wraps.
2. Plug the solenoid/probe connector into the BUS connection and secure with a screw on the right and left side. The connector is keyed.
3. Loosen the terminal screws on the solenoid. Slide the spade lug connectors under the screws and tighten to secure.
4. Connect power to the freezer. Turn the freezer On, with battery switch Off (O).
 - a. The Solenoid Engaged light on the BUS control panel will illuminate (no injection occurs). This light stays on until the unit is below BUS setpoint.
 - b. The Low Battery indicator may also illuminate.
5. Turn the battery switch to Standby mode (⏻) to charge both batteries.

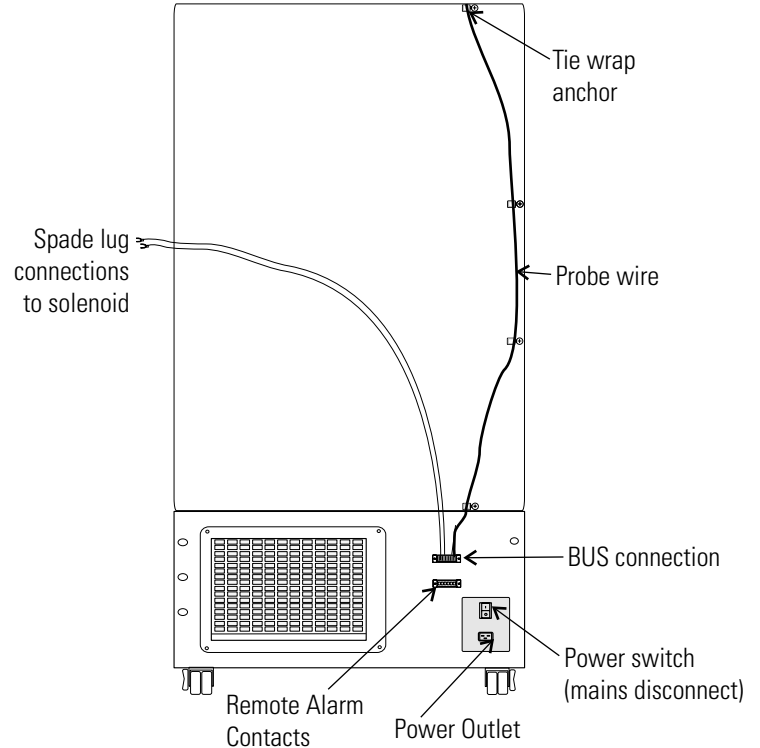


Figure 5-5

BUS Operation and Maintenance

a. BUS Control Panel (see Figure 5-6)

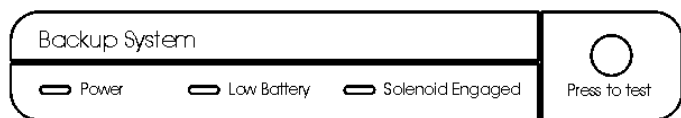


Figure 5-6



WARNING! When activated, this unit injects liquid nitrogen or carbon dioxide. Liquid Nitrogen can cause serious freezing (frostbite) if it comes in contact with unprotected skin or eyes. Nitrogen suppresses oxygen levels and may cause suffocation if area is not well ventilated. Refer to Appendix A for the proper handling of liquid LN₂.



CAUTION! Make sure the pressure relief valve on any LN₂ tank is adjusted to 30 PSI max blow-off.



Carbon Dioxide gas suppresses oxygen levels and may cause suffocation if area is not well ventilated. Refer to "Handling Liquid CO₂ in Appendix B.

Power - indicates the unit has AC power.

Low Battery - battery charge is low. The battery needs replaced or recharged.

Solenoid Engaged - BUS has opened the solenoid so it can inject gas (CO₂ or LN₂).

Press-To-Test - Activates the solenoid and injects LN₂ or CO₂ into the freezer chamber as long as the button is depressed. The solenoid engaged indicator should light. If the Low Battery indicator lights during the test, replace the BUS battery. **Note: solenoid will not engage if door is open.**

b. Configuring the Optional BUS (Back Up System)

The optional BUS can be configured for LN₂ or CO₂ supply. To select the supply type:

1. Press the Mode key until the Backup indicator lights.
2. Press the up or down arrow key. The display will show OP1 for CO₂ selection and OP2 for LN₂ selection.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

c. Setting the Optional BUS Set Point

The optional back up system is designed to inject CO₂ or LN₂ into the freezer compartment if the temperature rises above back up system set point. To set the BUS set point:

1. Press the Mode key until the Set Temperature and Backup indicators light.
2. Press the up or down arrow key until the desired BUS set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.



Changing the operating temperature set point can affect the BUS set point. The BUS set point will self adjust to maintain a temperature of at least 10°C above the operating temperature set point.



The BUS set point can not be set any colder than the high temperature alarm set point. (See section 1.6.b).

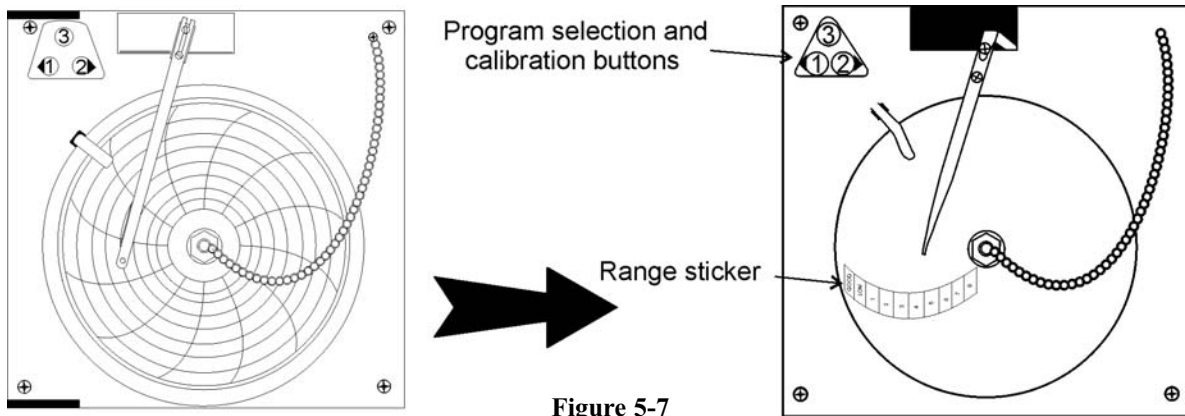
d. Cleaning the Vent Stack

Routinely check the vent stack for frost or ice build-up. The type of frost that forms in the vent stack is generally very soft and may be easily removed with a bristle brush or soft cloth. If ice build-up has occurred, a complete defrost may occasionally be required. See section 4.4 for freezer defrost instructions.

e. Disconnecting the Fitting Assembly and Transfer Hose

To disconnect the freezer back-up from the gas supply:

1. Close the supply valve.
2. Depress the test button on the BUS control box to remove the gas from the line.
3. Slowly disconnect the fitting assembly from the supply (in the event that any gas remains in the line).

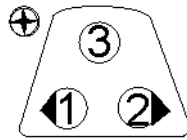


**Figure 5-7
Recorder Details**

5.2 Chart Recorder

a. Installing the Chart Paper

1. Open the glass door of the recorder and press button #3 until the pen begins to move outward.
2. Unscrew the knob at the center of the chart and remove the paper.
3. Install the new chart paper, position the paper to the correct time line and replace the knob.
4. Remove the cap from the felt pen and press button #3.



**Figure 5-8
Recorder Buttons**

Program	From	To
1	-40	30°C
2	0	60°C
3	-100	38°C
4	-5	50°C
5	0	100°C
6	-100	200°C
7	-115	50°C
8	-10	70°C

Calibrating the Chart Recorder:

The recorder must be in service for 24 hours before performing the following calibration procedure.

1. Place an accurate thermometer in the chamber next to the recorder probe.
2. Temperature probes for the recorder are located in the left front corner of the freezer chamber (Figure 1-4).
3. After about three minutes, compare the thermometer reading with the chart recorder reading.
4. If an adjustment is necessary, press the #1 button to move the pen to the left or the #2 to move the pen to the right. The button must be held about five seconds before the pen begins to move. Release the button when the pen position matches the thermometer.

b. Recorder Calibration

Changing the Recorder Range:

The chart recorder contains eight temperature ranges and is factory-programmed for the freezer.

1. Press and hold button #3 for one second, then let the pen move off the chart paper.
2. Press and hold for five seconds either button #1 or button #2.
3. Release the button and the green LED will begin to flash. Count the number of flashes to determine the present program setting.
4. To change the program setting, press the left or right arrows to increase or decrease the count.
5. When the desired program number is flashing, press button #3 to bring the pen arm back onto the chart. Recording will begin in the new program.

NOTE: The felt-tip pen on the recorder requires periodic replacement. Usually the ink will appear to fade before replacement becomes necessary. Additional pen tips may be purchased from Thermo. Refer to Parts List, Section 8.

5.3 Datalogger

Dataloggers and ELPRO evaluation software provide monitoring and documentation of temperature and alarm conditions. The dataloggers have a memory capacity of 64,000 measured values or data points. Temperature is measured, stored and displayed. Alarm conditions are recorded. Optional evaluation software permits data to be downloaded to a PC. A variety of statistical information is provided through calculations, analysis, graphs and printed reports. Refer to the ELPRO documentation for operating instructions for the datalogger.

5.4 Five Inner Door Option (P/N 189405, 189406, 189407, 195642)

The five inner door option is factory installed. The freezer is converted to accommodate four adjustable specimen shelves with the fifth “shelf” as the bottom of the freezer chamber

Specifications				
Model	722	727	728	729
Temperature Range	-10°C (-14°F) to -40°C (-40°F)			
Exterior Dimensions	33.3"W x 77.8"Hx31.0" 84.6x197.6x78.7cm	33.3"W x 77.8"Hx31.0" 84.6x197.6x78.7cm	33.3"W x 77.8"Hx37.0" 84.6x197.6x94.0cm	33.3"W x 77.8"Hx37.0" 84.6x197.6x94.0cm
Interior Dimensions	23.0"Wx51.5"Hx19.3" 58.4x130.8x49.0cm	23.0"Wx51.5"Hx19.3" 58.4x130.8x49.0cm	23.0"Wx51.5"Hx25.3" 58.4x130.8x64.3cm	23.0"Wx51.5"Hx25.3" 58.4x130.8x64.3cm
Capacity	13.0 cu. ft. (368.1 liters)	13.0 cu. ft. (368.1 liters)	17.3 cu. ft. (489.9 liters)	17.3 cu. ft. (489.9 liters)
Refrigeration	One 1 HP (2545 BTUH each)			
Insulation	Non-CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 4.5" (11.4 cm) door			
Electrical	120V,50/60Hz, 10.0FLA Operating Range: 108VAC-130VAC	230V, 60 Hz, 6.5 FLA Operating Range: 208-230V	120V,50/60Hz, 10.0FLA Operating Range: 108VAC-130VAC	230V,50/60Hz, 6.5FLA Operating Range: 208VAC-240VAC
Breaker Requirements	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker
Shipping Weight: Motor	770 lbs. (349.3 kg)	770 lbs. (349.3 kg)	795 lbs. (360.6 kg)	795 lbs. (360.6 kg)

Certifications

Declaration of Conformity is available from the factory

Safety Specifications

Indoor Use Only

Altitude - Up to 2,000 meters

Temperature - 5°C to 43°C

Humidity - Maximum RH 80% for temperatures up to 31°C, decreasing linearly to 50% RH at 40°C

Mains Supply Fluctuations - Mains supply voltage fluctuations not to exceed $\pm 10\%$ of the nominal voltage

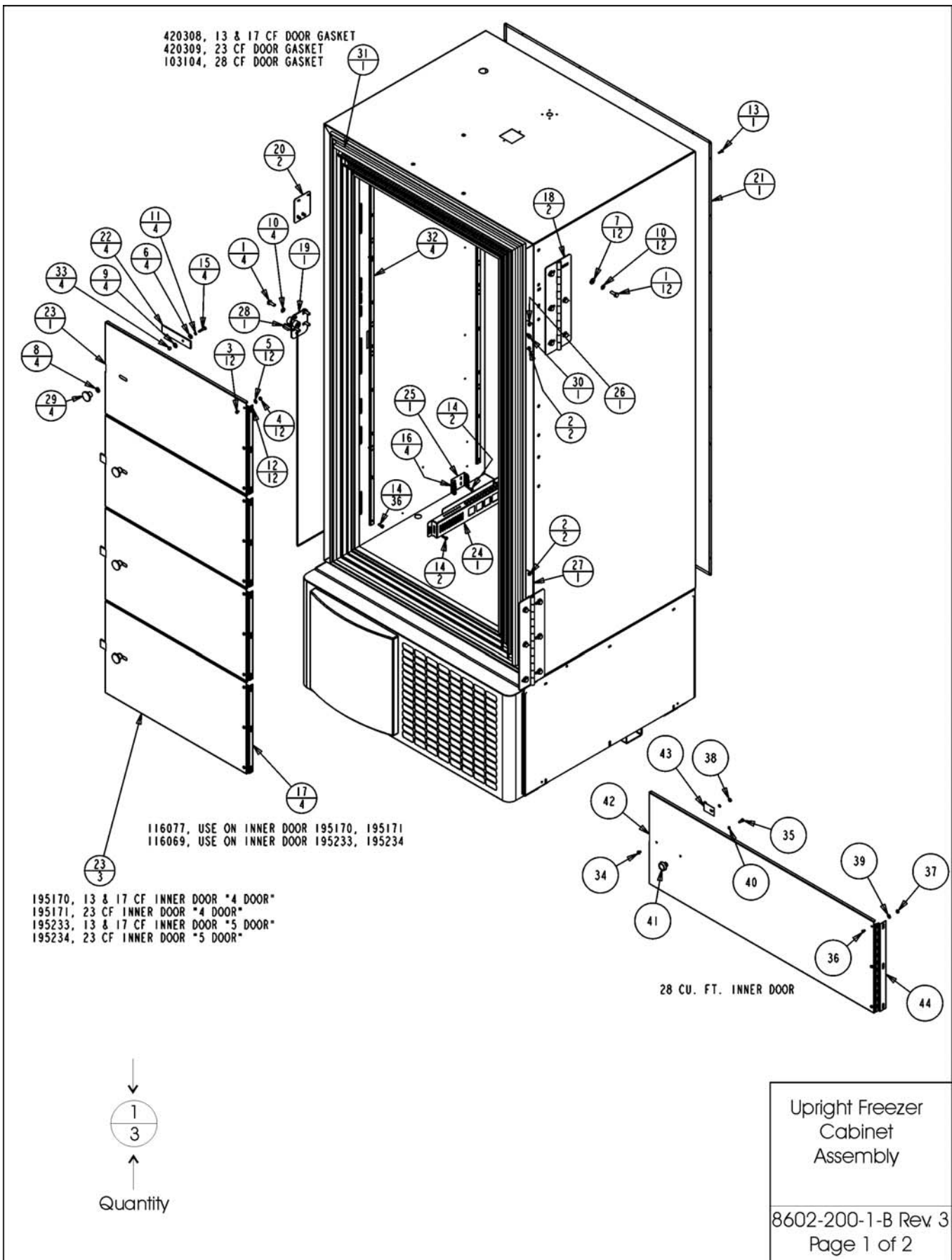
Installation Category II ¹

Pollution Degree 2 ²

Class of Equipment I

¹ Installation category (overvoltage category) defines the level of transient overvoltage which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply.

² Pollution degree describes the amount of conductive pollution present in the operating environment. Pollution degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.



BILL OF MATERIALS

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
1	FR-1673	06-05-03	PDK	PDK	LDN	ADDED VACUUM RELIEF PORT
2	FR-1698	09-19-03	JDL	PDK	LDN	ADDED SCREW TO VACUUM RELIEF PORT
3	FR-1789	06-02-05	DHG	DHG	AKS	REMOVED VRP IN TOP OF CABINET, DMHVRP

ITEM NO.	PART NO.	PART DESCRIPTION
1	20003	1/4-20 X 3/4 SS HH CAP SCREW
2	22053	#8-32 X 1/2 SS PHP SCREW
3	22115	#6-32 X 1/4 SS PHP SCREW
4	23009	#6-32 SS HEX NUT
5	23020	#6 SS FLAT WASHER
6	23021	#8 SS FLAT WASHER
7	23023	1/4 SS FLAT WASHER
8	23043	NYLON FLAT WASHER
9	23044	1/4" NYLON SHOULDER WASHER
10	23062	1/4 SS EXT TOOTH LOCKWASHER
11	23080	#8 SS SPRING LOCKWASHER
12	24032	#8-32 X 3/8 SS PHP SCREW F POINT
13	24041	#6-32 X 1/2 SS PHP SCREW F POINT
14	24042	#8-32 X 1/2 SS PHP SCREW F POINT
15	59008	#8-32 X 7/8 SS PHP SCREW
16	114020	5/8" X 1/2" ID GROMMET
17	116077	FRONT PANEL HINGE
18	116092	EXTERIOR FREEZER DOOR HINGE
19	121069	FREEZER CAM LATCH STRIKE
20	180312	CAM LATCH STRIKE COVER
21	189921	EXTERIOR BACK I3 & I7
22	195169	LATCH TAB
23	195170	13/17 CU. FT. INNER DOOR
24	195866	PROBE GUARD
25	195867	PROBE MOUNT
26	195874	CABINET CABLE COVER PLATE
27	195879	CABINET CABLE BLANK COVER PLATE
28	195900	SINGLE DOOR SWITCH ASSY.
29	285658	BLACK PLASTIC KNOB
30	330010	1/2" SPLIT SNAP BUSHING
31	420308	I3 & I7 CU. FT. SINGLE DOOR FRAME GASKET
32	500177	PILSATER STRIPS
33	515083	1/4 DIA. X 1/4L SS SPACER
34	22051	#8-32 X 1/4 SS PHP SCREW
35	22053	#8-32 X 1/2 SS PHP SCREW
36	22115	#6-32 X 1/4 SS PHP SCREW
37	23009	#6-32 SS HEX NUT
38	23010	#8-32 SS HEX NUT
39	23020	#6 SS FLAT WASHER
40	23080	#8 SS SPRING LOCKWASHER
41	120400	BLACK PLASTIC KNOB
42	195511	28 CU. FT. INNER DOOR
43	195602	LATCH TAB
44	116090	FRONT PANEL HINGE

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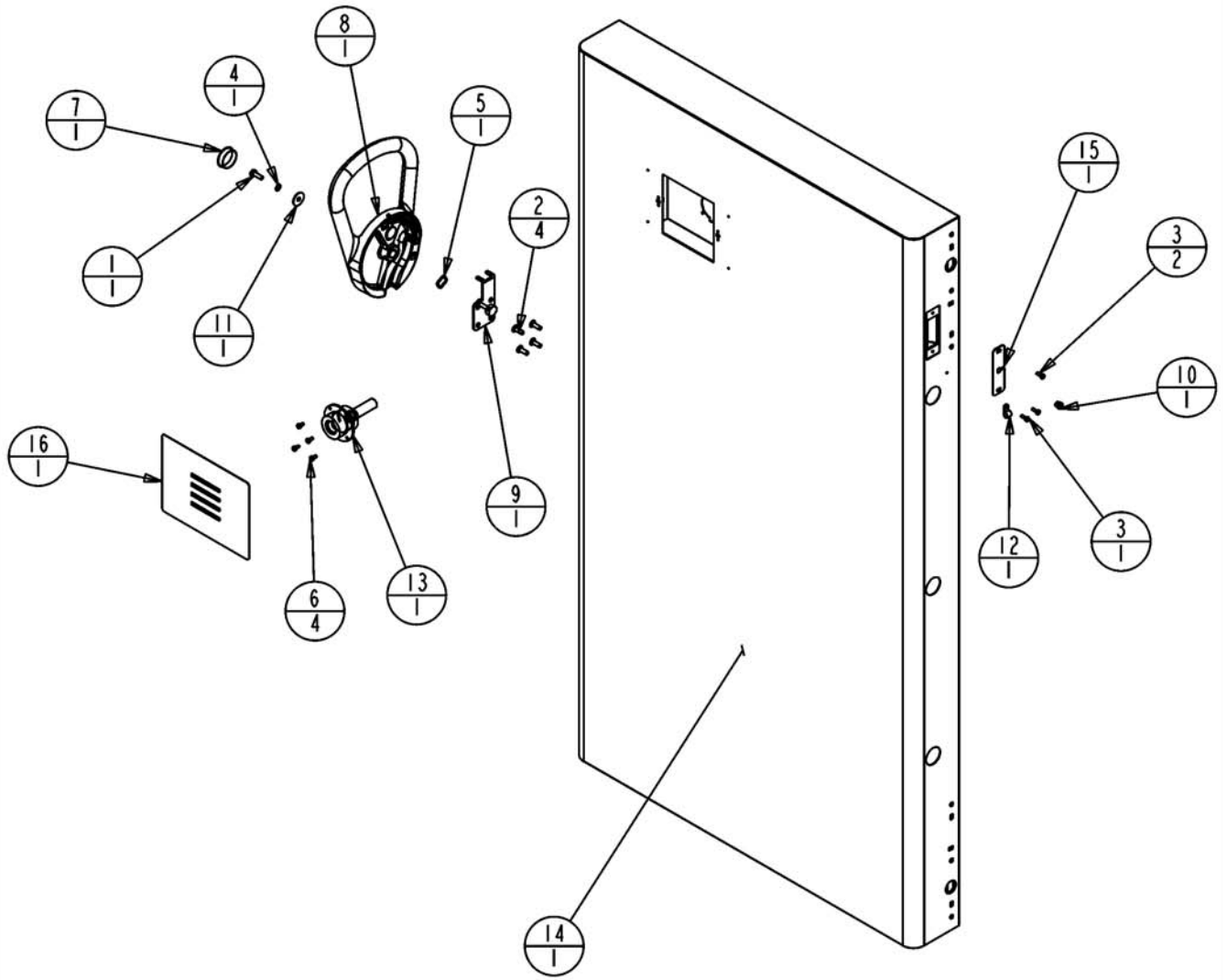
MODEL/PART NAME: 8600 UP-RIGHT FREEZER
 DWG TITLE: 8602 UP-RIGHT FREEZER ASSEMBLY
 DWN: PDK CAD: PDK APPD: MAH DATE: 10-30-02 SCALE: 0.094

Upright Freezer
 Cabinet
 Assembly



MATERIAL: N/A
 PAINT: N/A
 TOLERANCE UNLESS OTHERWISE SPECIFIED ANGLES: DECIMAL: .XX=± .XXX=±
 DRAWING NUMBER: 8602-200-1
 SIZE: B

8602-200-1-B Rev. 3
 Page 2 of 2



Part Number



Quantity

700 Series
Upright Freezer
Door Assembly

702-201-1-B Rev 1
Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	12-11-02	PDK	PDK	LDN	RELEASED FOR PRODUCTION
1	FR-1789	06-10-05	KRH	KRH	AKS	ADDED DMHVRP

BILL OF MATERIALS

ITEM NO.	PART NO.	PART DESCRIPTION
1	20003	1/4-20 X 3/4 SS HH CAP SCREW
2	20058	#1/4-20 X 3/4 SS FHP UC SCREW
3	22053	#8-32 X 1/2 SS PHP SCREW
4	23033	1/4 SS INTERNAL TOOTH LOCK WASHER
5	23057	5/8 WAVE WASHER
6	24032	#8-32 X 3/8 SS PHP SCREW F POINT
7	117038	1-3/8" DIA. THERMO WHITE HOLE PLUG
8	121068	121068 FINISHED HANDLE/LATCH ASSEMBLY
9	121075	CAM LATCH MOUNT
10	340036	STRAIN RELIEF BUSHING
11	510305	1" OD FLAT WASHER
12	600085	5/16 NYLON CABLE CLAMP
13	1950096	HEATED VACUUM RELIEF PORT
14	1950088	13 & 17 CU. FT. UPRIGHT FREEZER DOOR "700"
15	1950094	UPRIGHT DOOR WIREWAY COVER PLATE
16	1950095	VRP COVER PLATE

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MODEL/PART NAME: ULT UP-RIGHT SERIES FREEZER
 DWG TITLE: 700/5700 SINGLE DOOR BOM ASSEMBLY
 DWN: PDK CAD: PDK APPD: DATE: 10-30-02 SCALE: 0.094

700 Series
 Upright Freezer
 Door Assembly



MATERIAL: N/A
 PAINT: N/A
 TOLERANCE UNLESS OTHERWISE SPECIFIED
 ANGLES: DECIMAL: .XX±
 .XXX±
 DRAWING NUMBER: 702-201-1
 SIZE: B

702-201-1-B Rev. 1
 Page 2 of 2

BILL OF MATERIALS

ITEM NO.	PART NO.	PART DESCRIPTION
1	23002	#8-32 ZP LKWASH HEX NUT
2	23011	1/4-20 ZP LKWASH HEX NUT
3	23013	3/8-16 ZP LKWASH HEX NUT
4	24016	#6 X 1/2" SS PHP SCREW AB POINT
5	24030	#8 X 1/2" TEKS SCREW
6	24032	#8-32 X 3/8 SS PHP SCREW F POINT
7	24038	1/4-20 X 1/2 SELF TAPPING SCREW
8	24049	1/4 ZP FLAT WASHER
9	25040	#6 U SPEED NUT STL. STL.
10	30016	1" SNAP BUSHING
11	108020	10" WIRE FAN GUARD
12	114033	COMPRESSOR MOUNTING FOOT
13	114034	COMPRESSOR MOUNTING SLEEVE
14	115032	BLACK ABS PLASTIC PULL
15	116115	FRONT PANEL HINGE
16	120011	DUAL WHEEL CASTER
17	140368	CONTROL PANEL ASSEMBLY
18	180305	THERMO CONTROL CENTER DISPLAY BEZEL
19	180306	THERMO BACK-UP SYSTEM BLANK PANEL
20	180308	THERMO CONTROL CENTER RECORDER BLANK
21	191803	FREEZER DISPLAY BOARD
22	195837	MOUNTING ANGLE FOR 180305
23	200126	2" RIGID HANGER
24	203031	230V HIGH STAGE COMPRESSOR
25	204009	REFRIGERATION CONDENSER
26	209020	LIQUID LINE FILTER DRYER WITH ACCESS PORT
27	214006	OIL SEPARATOR
28	330002	5/8" SNAP BUSHING
29	330010	1/2" SPLIT SNAP BUSHING
30	360248	MINI SNAP-IN POWER SWITCH
31	400159	SEALED LEAD ACID BATTERY - 12 VOLT - 7.2 Ah
32	510035	#12-24 X 1/2 SS HH CAP SCREW
33	550043	1/4-20 X 1"L ZP CARRIAGE BOLT
34	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
35	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
36	590029	#8-32 X 3/8 SS PHP EXT SEMS SCREW W/PATCH
37	600080	1/4 ALUM CLAMP W/LINER
38	680008	1/4-20 X 1-3/4 SELF TAPPING SCREW
39	730087	#12 SS EXT TOOTH LOCKWASHER
40	760203	AIR FILTER
41	900113	10" TUBEAXIAL FAN, 115V
42	1950074	BATTERY MOUNTING BRACKET
43	121071	LATCH CATCH, PART OF 121071 ASSEMBLY
44	121071	LATCH KEEPER, PART OF 121071 ASSEMBLY
45	195746	13&17 CU. FT. UR FRZ BASE FRONT PNL,760&8600
46	195799	SIDE PANEL 17, 23 AND 28 CU. FT. UPRIGHT
47	195802	13/17 REAR ACCESS GRILLE

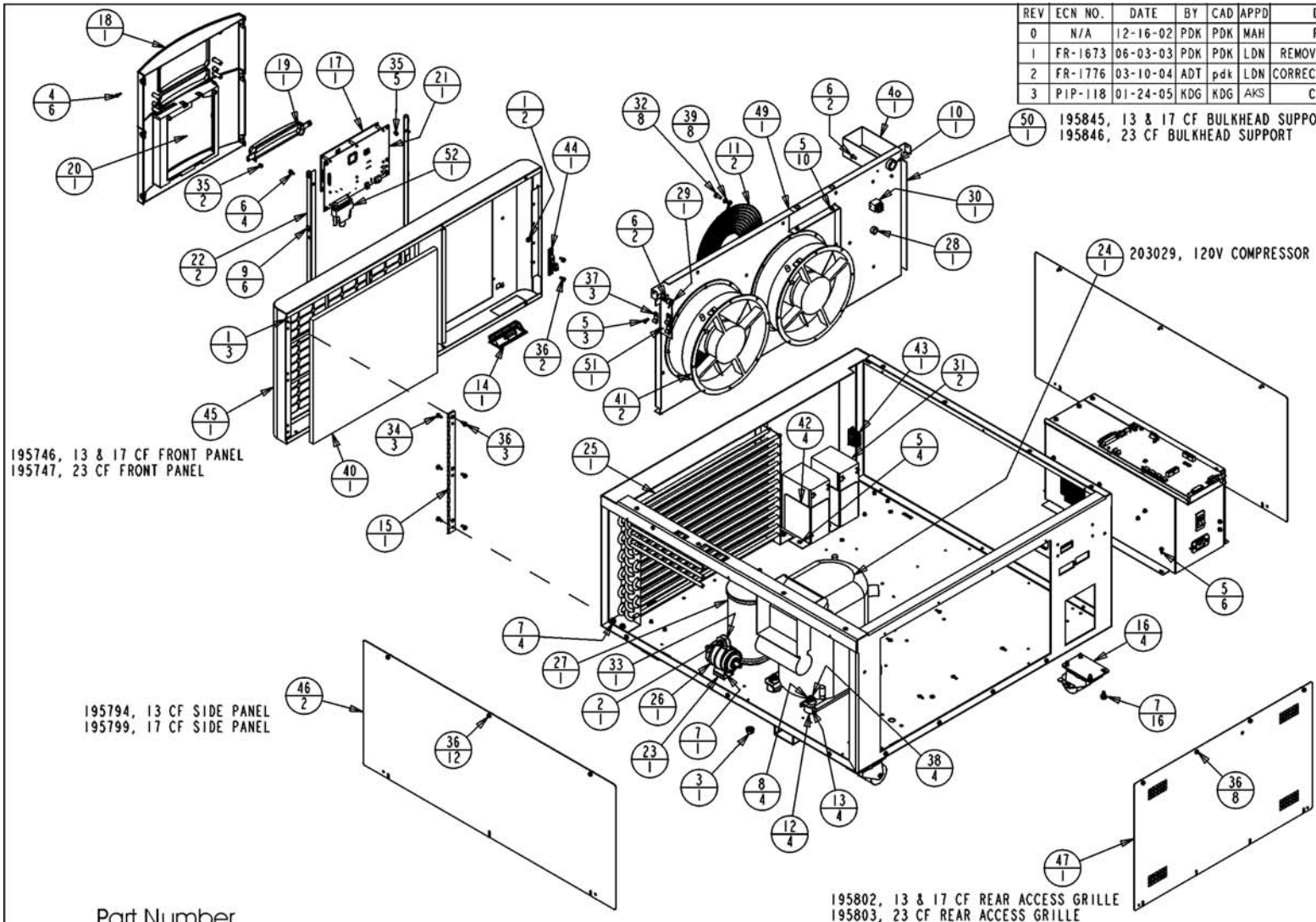
48	195829	MULLION/DOOR SWITCH WIRE COVER
49	195844	UR FRZ FAN BULKHEAD
50	195845	13&17 CU. FT. FAN BULKHEAD SUPPORT
51	195882	REFRIGERATION LINE SUPPORT BRACKET
52	430336	15 FT. RS-232 CABLE 25 POS.

Exploded Parts
 Model: 700 Series
 -40C
 Upright Freezers

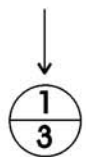
702-203-2-B Rev. 3
 Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	12-16-02	PDK	PDK	MAH	RELEASED FOR PRODUCTION
1	FR-1673	06-03-03	PDK	PDK	LDN	REMOVED HEATER, REVISED HARDWARE
2	FR-1776	03-10-04	ADT	pdk	LDN	CORRECTED CONTROL PANEL STK NUMBER
3	PIP-118	01-24-05	KDG	KDG	AKS	CHANGED BATTERY MOUNTING

195845, 13 & 17 CF BULKHEAD SUPPORT
 195846, 23 CF BULKHEAD SUPPORT



Part Number



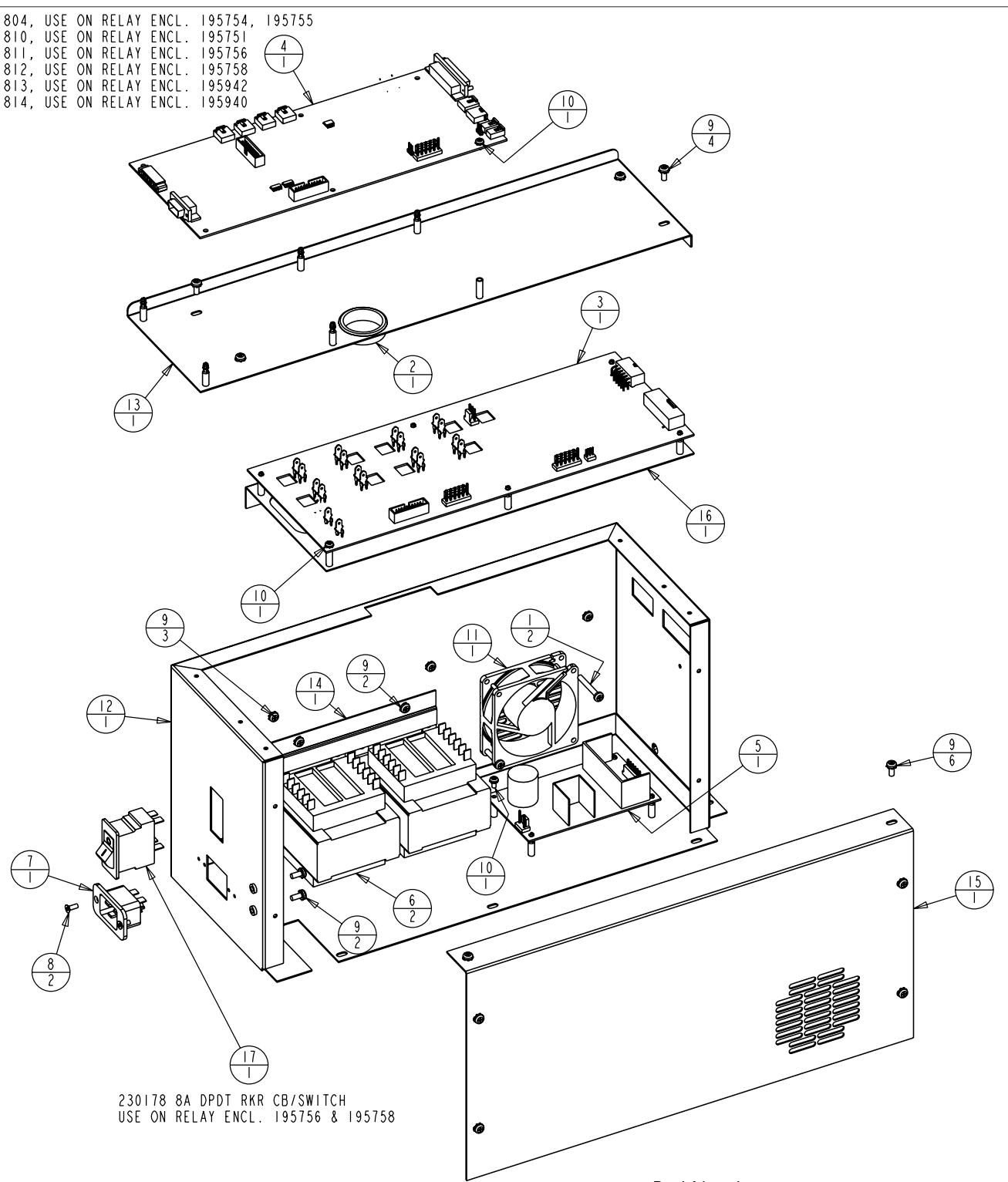
Quantity

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Thermo
 ELECTRON CORPORATION
 Controlled Environment Equipment
 Box 649, Marietta, Oh 45750

MODEL/PART NAME: 8600 UP-RIGHT FREEZER					
DWG TITLE: 729 UP-RIGHT FREEZER ASSEMBLY					
DWN: PDK	CAD: PDK	APPD: MAH	DATE: 10-30-02	SCALE: 0.094	
MATERIAL: N/A					
PAINT: N/A					
TOLERANCE UNLESS OTHERWISE SPECIFIED			DRAWING NUMBER	SIZE	702-203-2-B Rev. 3 Page 2 of 2
ANGLES: DECIMAL: .XX± .xxx±			702-203-2	B	

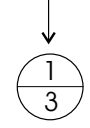
191804, USE ON RELAY ENCL. 195754, 195755
 191810, USE ON RELAY ENCL. 195751
 191811, USE ON RELAY ENCL. 195756
 191812, USE ON RELAY ENCL. 195758
 191813, USE ON RELAY ENCL. 195942
 191814, USE ON RELAY ENCL. 195940



230178 8A DPDT RKR CB/SWITCH
 USE ON RELAY ENCL. 195756 & 195758

I. COMMON TO: 195751, 195754, 195755, 195756, 195758, 195940 & 195942

Part Number



Quantity

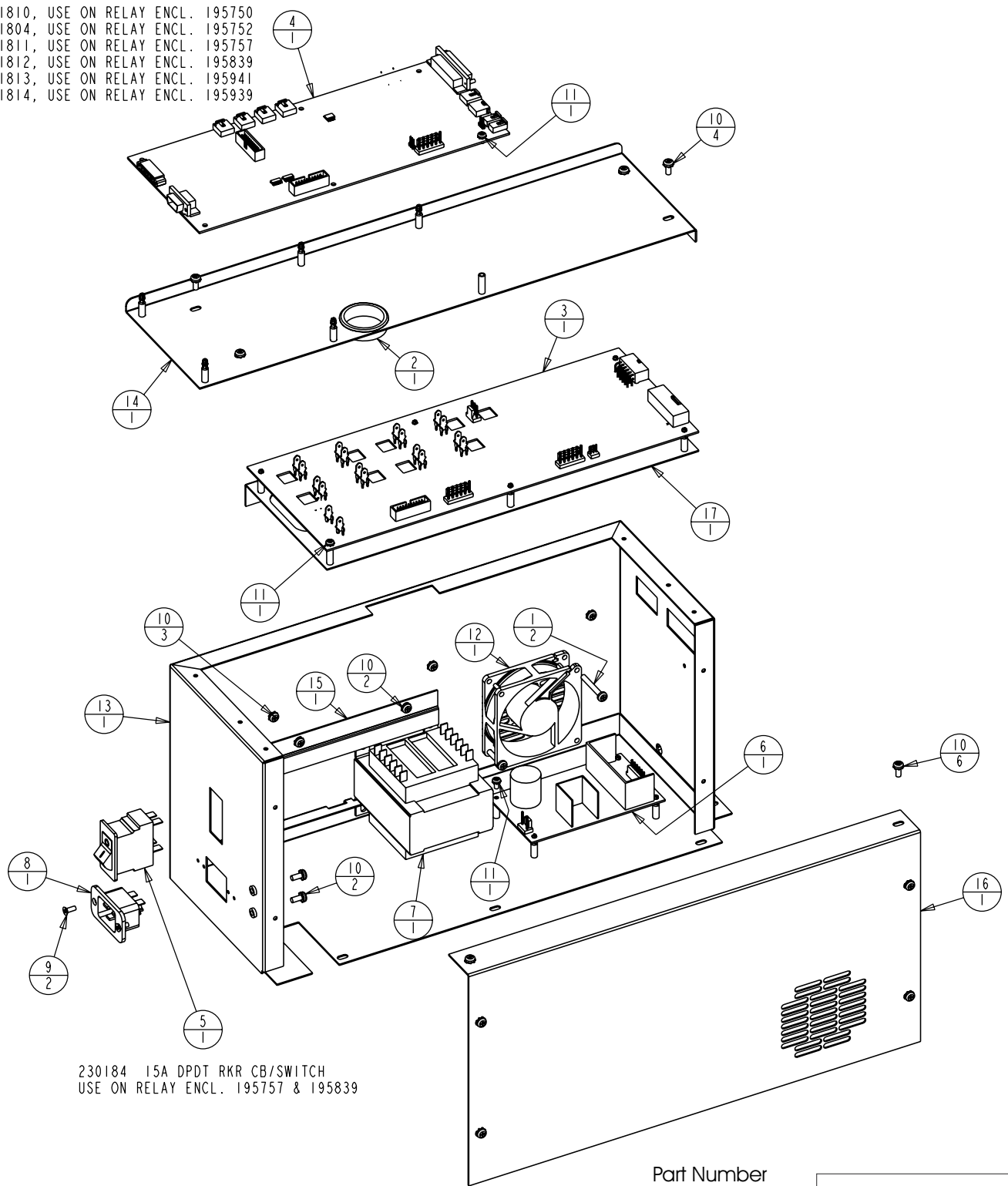
230 Volt Relay Enclosure Assembly
8602-204-1-B Rev. 4 Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	12-02-02	PDK	PDK	MAH	RELEASED FOR PRODUCTION
1	FR-1673	03-06-03	DHG	KDG	LDN	MADE COMMON TO 195940 & 195942
2	FR-1789	07-28-04	ADT	KDG	LDN	CHG. MICRO BOARD FOR VACUUM RELIEF
3	PIP-111	08-02-04	TJ	KDG	LDN	REMOVED 114031 GROMMET EDGING
4	FR-1806	08-23-04	JDL	KDG	AKS	SPECIFIED AMPERAGE OF CB SWITCHES

BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	22143	#8-32 x 1-1/4 SS PHP SCREW
2	30077	1-1/2" SNAP BUSHING
3	191658	HIGH VOLTAGE BOARD 230V
4	191804	MICRO BOARD (-86 HIGH END)
5	400165	SWITCHER BOARD
6	420090	175V TRANSFORMER
7	460169	POWER INLET, 16/20A
8	490009	#6-32 X 3/8 SS FHP UC SCREW
9	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
10	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
11	900134	TUBEAXIAL FAN, 30 CFM, 12V
12	195631-16-1	RELAY ENCLOSURE SPOTWELD SUB-ASSEMBLY
13	195631-16-4	RELAY ENCLOSURE COVER/191656 SUPPORT
14	195631-31-3	TRANSFORMER HOLD DOWN
15	195631-31-5	RELAY ENCLOSURE COVER (MAIN)
16	195730-16-1	191658 SUPPORT BRACKET SUB-ASSEMBLY
17	230184	15A DPDT SWITCH/CIRCUIT BKR

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	DWG TITLE: 230 VOLT RELAY ENCLOSURE ASSY (HIGH END)					
	DWN: DHG	CAD: DHG	APPD: MAH	DATE: 07-26-01	SCALE: 0.250	
	MATERIAL: -					
PAINT: N/A					DRAWING NUMBER 8602-204-1	SIZE B
TOLERANCE UNLESS OTHERWISE SPECIFIED ANGLES: DECIMAL: .XX± .xxx±						
Thermo ELECTRON CORPORATION Controlled Environment Equipment Box 649, Marietta, Oh 45750						8602-204-1-B Rev 4 Page 2 of 2

191810, USE ON RELAY ENCL. 195750
 191804, USE ON RELAY ENCL. 195752
 191811, USE ON RELAY ENCL. 195757
 191812, USE ON RELAY ENCL. 195839
 191813, USE ON RELAY ENCL. 195941
 191814, USE ON RELAY ENCL. 195939



230184 15A DPDT RKR CB/SWITCH
 USE ON RELAY ENCL. 195757 & 195839

1. COMMON TO: 195750, 195752, 195757, 195839, 195939 & 195941

Part Number



Quantity

120 Volt
 Relay Enclosure
 Assembly

8602-204-2-B Rev. 4
 Page 1 of 2

HIGH TEMP STAGE

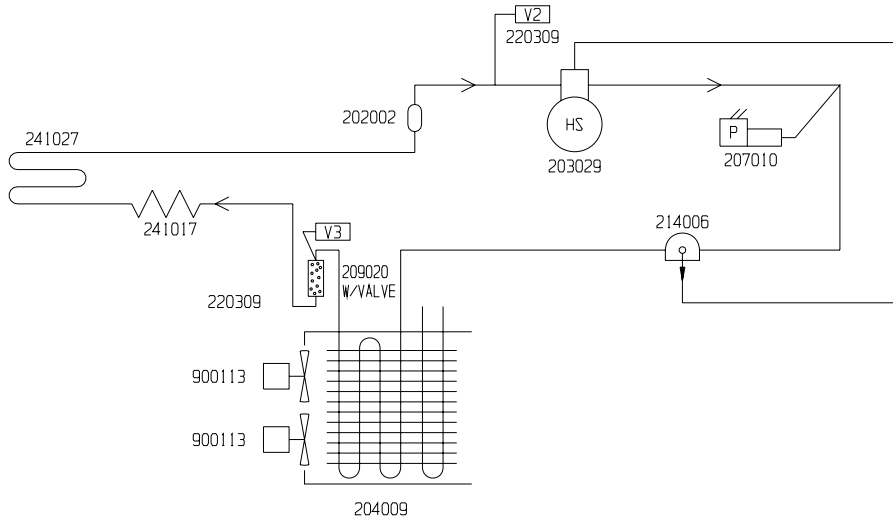
REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT :

UPRIGHTS

13.0 CU.FT. UNITS: R-404A 18 OZ. (510gr) ±1/2 OZ (14gr)
 17.0 CU.FT. UNITS: R-404A 18 OZ. (510gr) ±1/2 OZ (14gr)

HIGH TEMPERATURE STAGE OIL :MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
 COMPRESSOR, 24 OZ.(710ml)



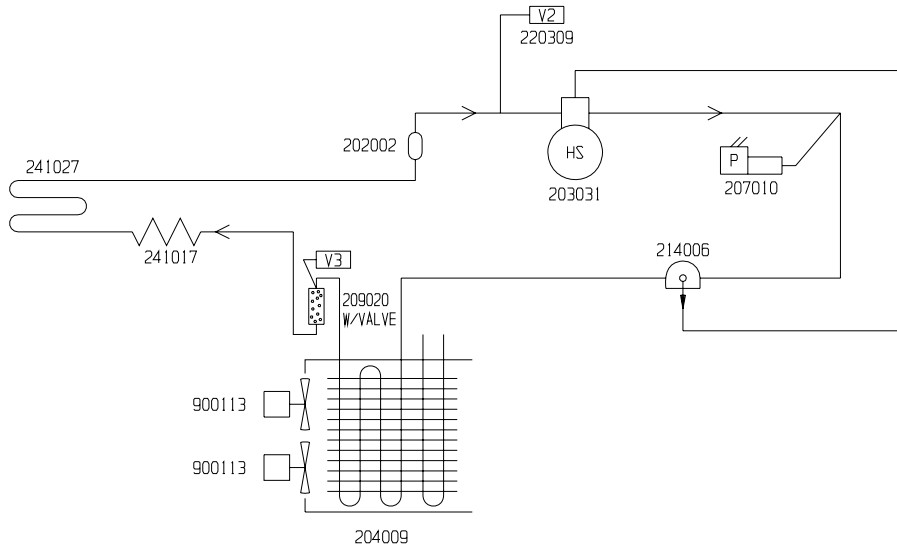
- 1. COMMON TO: 722, 5722, 8624 13.0 CU.FT. UPRIGHT FREEZERS (120 V)
 728, 5728 17.0 CU.FT. UPRIGHT FREEZERS (120 V)

CUSTOMER APPROVAL/REFERENCE						
APPROVED BY	_____					
APPROVING FIRM	_____					
DATE OF APPROVAL	_____					
REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
2	FR-1867	07-26-05	RDS	DHG		REMOVED 220554 AND ADDED 220309
1	N/A	01-07-03	MAH	POK	LDN	CORRECTED COMPRESSOR STOCK NUMBER
0	N/A	11-05-02	MAH	KDG	MAH	RELEASED FOR PRODUCTION
DATE	11-05-02	DWN	MAH	CAD	KDG	APPD MAH SCALE NONE
CUSTOMER						
JOB TITLE -40°C ULTRA-LOW TEMPERATURE FREEZERS, 120V						
DWG TITLE REFRIGERATION SCHEMATIC						
LOCATION		JOB NUMBER		DRAWING NUMBER		
FREEZERS				722-90-0-B		



HIGH TEMP STAGE

REFRIGERATION



HIGH TEMPERATURE STAGE REFRIGERANT:

UPRIGHTS
 13.0 CU.FT. UNITS: R-404A 18 OZ. (510gr) ±1/2 OZ (14gr)
 17.0 CU.FT. UNITS: R-404A 18 OZ. (510gr) ±1/2 OZ (14gr)

HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
 COMPRESSOR, 24 OZ. (710ml)

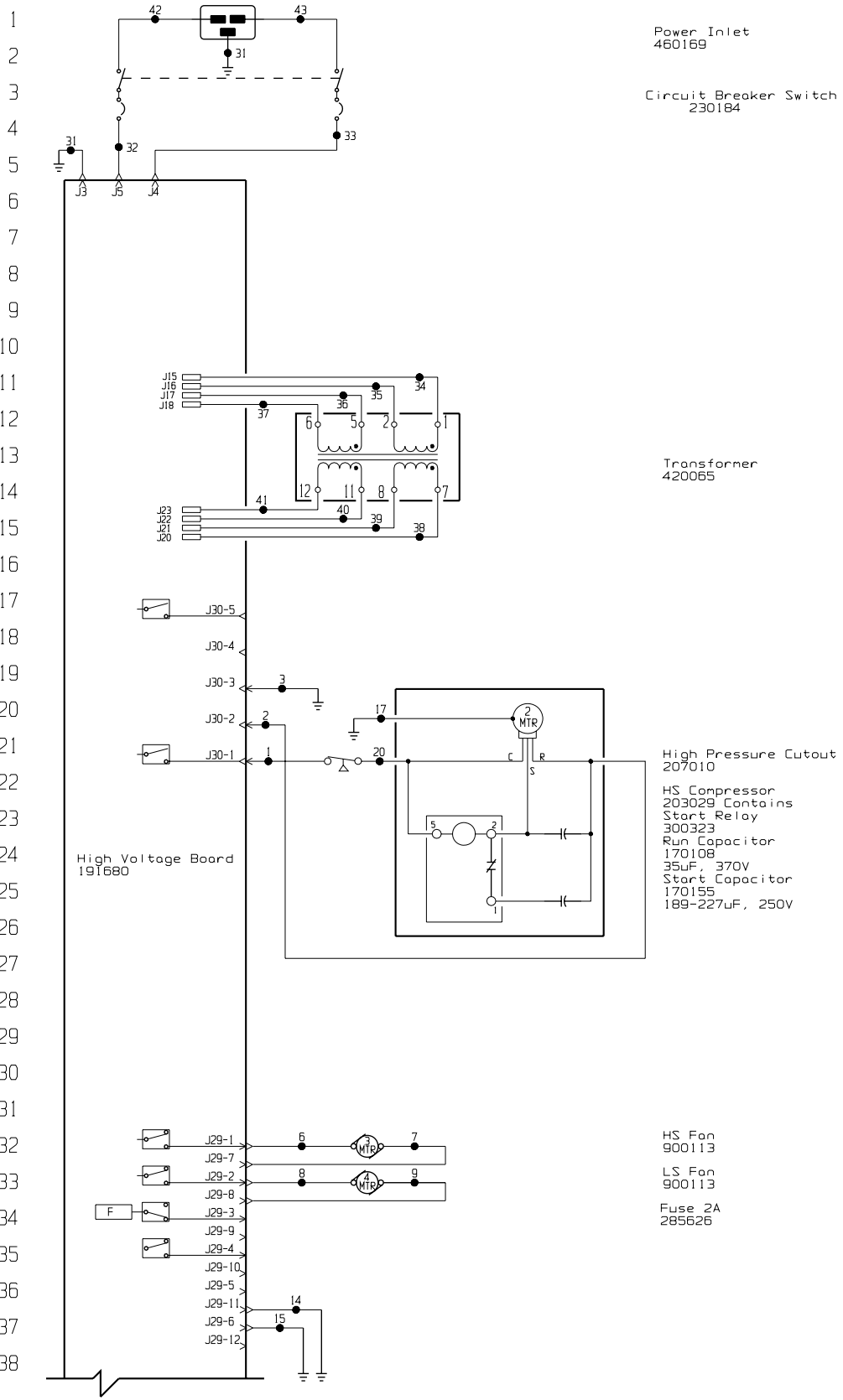
8-2

1. COMMON TO: 727, 5727, 8626 13.0 CU.FT. UPRIGHT FREEZERS (230 V)
 729, 5729 17.0 CU.FT. UPRIGHT FREEZERS (230 V)

CUSTOMER APPROVAL/REFERENCE						
APPROVED BY	_____					
APPROVING FIRM	_____					
DATE OF APPROVAL	_____					
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REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	FR-1867	07-26-05	RDS	DHG		REMOVED 220554 AND ADDED 220309
2	FR-1664	01-24-03	MAH	PDK	LON	CHANGED 900111 FANS TO 900113
1	N/A	01-07-03	MAH	PDK	MAH	CORRECTED COMPRESSOR STOCK NUMBER
0	N/A	11-05-02	MAH	KDG	MAH	RELEASED FOR PRODUCTION
DATE	11-05-02	DWN	MAH	CAD	KDG	APPD MAH SCALE NONE
CUSTOMER						
JOB TITLE -40°C ULTRA-LOW TEMPERATURE FREEZERS, 230V						
DWG TITLE REFRIGERATION SCHEMATIC						
LOCATION		JOB NUMBER		DRAWING NUMBER		
FREEZERS				727-90-0-B		

Thermo
 ELECTRON CORPORATION

POWER CONNECTION
 120V, 1 ϕ , 2W, 60HZ, 10.0 FLA
 (OPERATING RANGE 108-130V)



Electrical Schematic
 Models:
 722, 728, 5722, 5728
 -40C Freezers

722-70-1-D Rev. 7
 Page 1 of 3

77						
78						
79	WIRE #	COLOR	GAUGE	WIRE #	COLOR	GAUGE
80	1	BLK	14	25	WHT	18
	2	RED	14	26	BLK	18
	3	GRN/YEL	14	27	BLK	18
	4			28	RED	18
	5			29	BLK	22
81	6	BLK	18	30	RED	22
	7	BLK	18	31	GRN/YEL	14
82	8	BLK	18	32	BLK	14
	9	BLK	18	33	BLU	14
	10			34	BLK	14
83	11			35	BLU	14
	12			36	BLK	14
	13			37	BLU	14
84	14	GRN/YEL	18	38	BLK	14
	15	GRN/YEL	18	39	BLU	14
85	16			40	BLK	14
	17	GRN/YEL	14	41	BLU	14
86	18			42	BLK	14
	19			43	BLU	14
	20	BLK	14			
87	21	BLK	18			
	22	RED	18			
88	23	BLK	18			
	24	RED	18			

SIZE	THERMO	VWR
13	722	5722
17	728	5728

REMOTE CONTACTS/ANALOG OUTPUT	
PIN# 1	Not Connected
PIN# 2	Not Connected
PIN# 3	Not Connected
PIN# 4	Not Connected
PIN# 5	Normally Closed
PIN# 6	Common
PIN# 7	Normally Open

CONTACT RATING: 1A @ 30V
CONTACTS IN ALARM STATE

1. Schematic represents single models.
2. Door switches shown in open position.
3. Battery switch shown in the OFF position.
4. Circuit breaker switch shown in OFF position.
5. Options and accessories shown in dashed lines.

7	FR-1854	06-13-05	HCE	GLS	AKS	REV. BATTERY CIRCUIT WIRING
6	FR-1789	06-13-05	RTB	KDG	LON	ADD VACUUM RELIEF HEATER
5	FR-1789	11-09-04	RTB	KDG	LON	CHG'D. DISPLAY BOARD 191674 TO 191803
4	FR-1789	08-14-04	ADT	KDG	LON	CHANGED MICRO BOARD 191697 TO 191812
3	FR-1698	05-07-03	HCE	KDG	MAH	REMOVED VACUUM RELIEF HEATER
REV	ECN NO.	DATE	BY	CAD	APPO	DESCRIPTION OF REVISION

Electrical Schematic
Models:
722, 728, 5722, 5728
-40C Freezers



ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

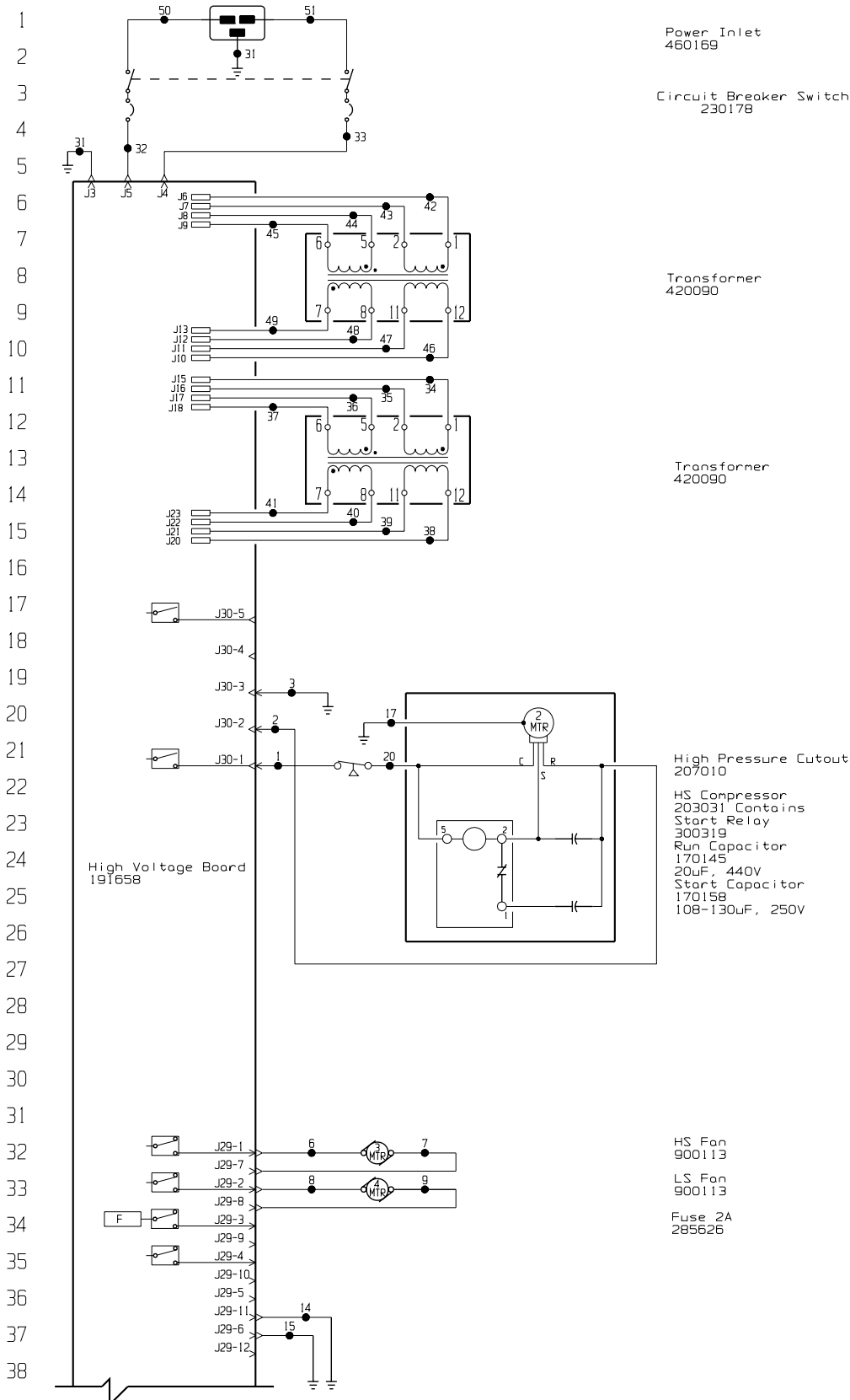
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Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Norietta, Oh 45750

MODEL/PART NAME: LHM-END, 120V, -40° FREEZERS					
DWG TITLE: UNIT SCHEMATIC					
DWN: ADT	CAD: ADT	APPO: MAH	DATE: 3-22-02	SCALE: NONE	
MATERIAL:					
PAINT COLOR:					
TOLERANCE UNLESS OTHERWISE SPECIFIED					
ANGLES:	DECIMAL:	XXX±	DRAWING NUMBER	SIZE	
		XXX±	722-70-1	0	

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Page 3 of 3

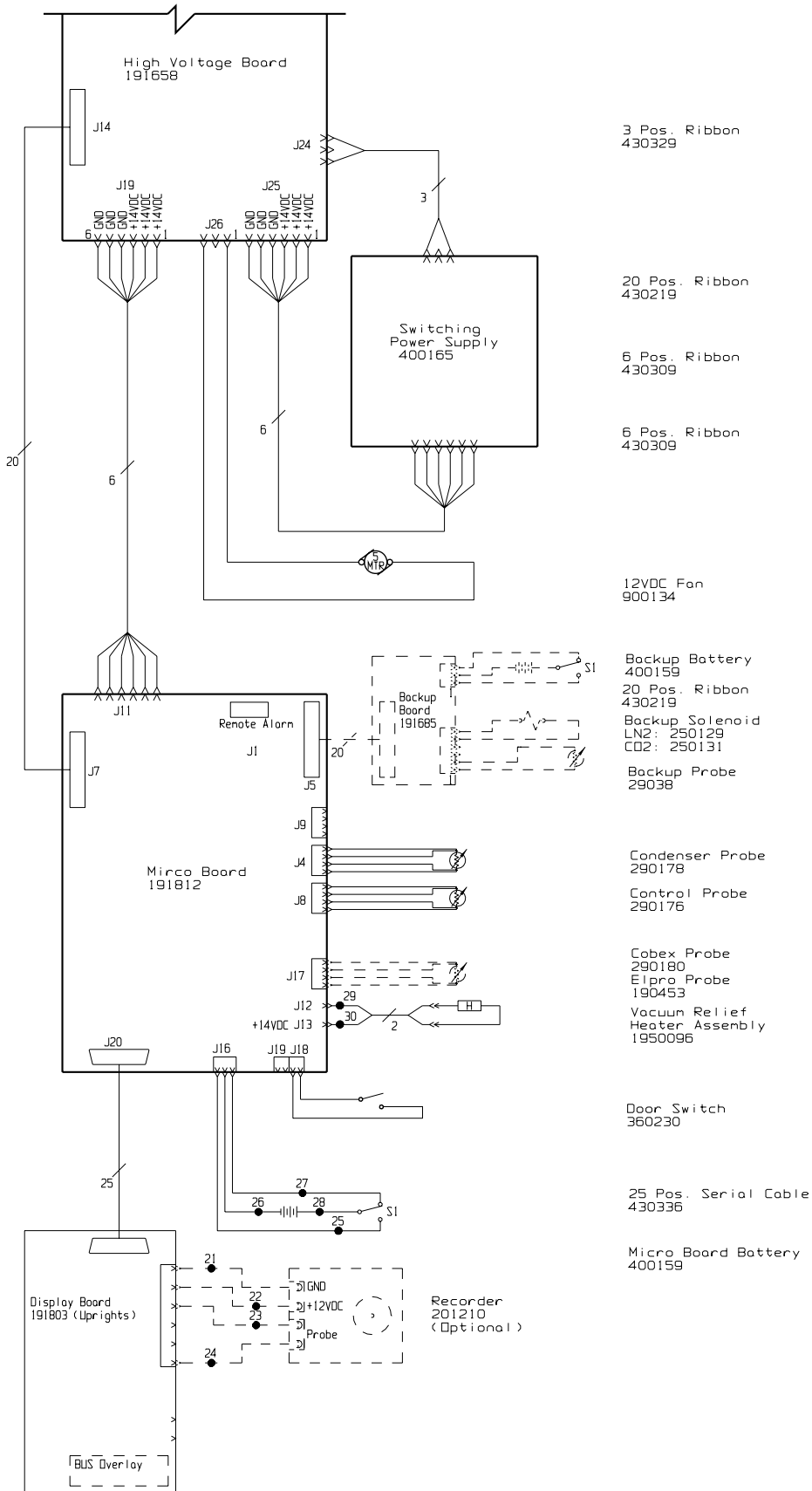
POWER CONNECTION
 230V, 1 ϕ , 2W, 50/60HZ, 6.5 FLA
 (OPERATING RANGE 208-240)



Electrical Schematic
 Models:
 727, 729, 5727, 5729
 -40C Freezers

727-70-1-D Rev. 6
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- 3 Pos. Ribbon
430329
- 20 Pos. Ribbon
430219
- 6 Pos. Ribbon
430309
- 6 Pos. Ribbon
430309
- 12VDC Fan
900134
- Backup Battery
400159
- 20 Pos. Ribbon
430219
- Backup Solenoid
LN2: 250129
CO2: 250131
- Backup Probe
29038
- Condenser Probe
290178
- Control Probe
290176
- Cobex Probe
290180
- Elpro Probe
190453
- Vacuum Relief
Heater Assembly
1950096
- Door Switch
360230
- 25 Pos. Serial Cable
430336
- Micro Board Battery
400159

Electrical Schematic
Models:
727, 729, 5727, 5729
-40C Freezers

727-70-1-D Rev. 6
Page 2 of 3

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WIRE #	COLOR	GAUGE	WIRE #	COLOR	GAUGE
1	BLK	14	25	WHT	18
2	RED	14	26	BLK	18
3	GRN/YEL	14	27	BLK	18
4			28	RED	18
5			29	BLK	22
6	BLK	18	30	RED	22
7	BLK	18	31	GRN/YEL	14
8	BLK	18	32	BLK	14
9	BLK	18	33	BLU	14
10			34	BLK	14
11			35	BLU	14
12			36	BLK	14
13			37	BLU	14
14	GRN/YEL	18	38	BLK	14
15	GRN/YEL	18	39	BLU	14
16			40	BLK	14
17	GRN/YEL	14	41	BLU	14
18			42	BLK	14
19			43	BLU	14
20	BLK	14	44	BLK	14
21	BLK	18	45	BLU	14
22	RED	18	46	BLK	14
23	BLK	18	47	BLU	14
24	RED	18	48	BLK	14
			49	BLU	14
			50	BLK	14
			51	BLU	14

SIZE	THERMO	VWR
13	727	5727
17	729	5729

REMOTE CONTACTS/ANALOG OUTPUT	
PIN# 1	Not Connected
PIN# 2	Not Connected
PIN# 3	Not Connected
PIN# 4	Not Connected
PIN# 5	Normally Closed
PIN# 6	Common
PIN# 7	Normally Open

CONTACT RATING: 1A @ 30V
CONTACTS IN ALARM STATE

1. Schematic represents upright models.
2. Door switch shown in open position.
3. Battery switch shown in the OFF position.
4. Circuit breaker switch shown in OFF position.
5. Options and accessories shown in dashed lines.

6	FR-1854	06-13-05	HCE	GLS	AKS	REV. BATTERY CIRCUIT WIRING
5	FR-1789	06-13-05	RTB	KDG	LDN	ADD VACUUM RELIEF HEATER
4	FR-1789	11-09-04	RTB	KDG	LDN	CHG'D. DISPLAY BOARD 191674 TO 191803
3	FR-1789	08-14-04	ADT	KDG	LDN	CHANGED MICRO BOARD 191697 TO 191812
2	FR-1698	05-07-03	HCE	KDG	MAH	REMOVED VACUUM RELIEF HEATER
REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION

Electrical Schematic
Models:
727, 729, 5727, 5729
-40C Freezers

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MODEL/PART NAME: LHM-END, 230V, -40° FREEZERS					
DWG TITLE: UNIT SCHEMATIC					
DWN: ADT	CAD: ADT	APPD: MAH	DATE: 3-22-02	SCALE: NONE	



Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Morristown, TN 37800

MATERIAL:		
PAINT COLOR:		
TOLERANCE UNLESS OTHERWISE SPECIFIED	DRAWING NUMBER	SIZE
ANGLES: DECIMAL: .XX± : : .XXX±	727-70-1	D

727-70-1-D Rev. 6
Page 3 of 3

THERMO FISHER SCIENTIFIC 700 SERIES ULT FREEZER WARRANTY USA

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period.

During the first year of the warranty period, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo Electron Corporation's expense, labor included. The 700 Series ULT Freezers include an additional two year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to any work being performed. Expendable items, i.e., glass, filters, pilot lights, light bulbs and door gaskets are excluded from this warranty.

Replacement or repair of component parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original one year warranty period. The Technical Services Department must give prior approval for the return of any components or equipment.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation, and preventive maintenance.

If equipment service is required, please call your Technical Services Office at 1-888-213-1790 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service, and special applications. Outside the USA, contact your local distributor for warranty information.



THERMO FISHER SCIENTIFIC 700 SERIES ULT FREEZER INTERNATIONAL DEALER WARRANTY

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period. Dealers who stock our equipment are allowed an additional four months for delivery and installation, providing the warranty card is completed and returned to the Technical Services Department.

During the first year of the warranty period, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo Electron Corporation's expense, labor excluded. The 700 Series ULT Freezers include an additional two year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to any work being performed. Expendable items, i.e., glass, filters, pilot lights, light bulbs and door gaskets are excluded from this warranty.

Replacement or repair of component parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original one year warranty period. The Technical Services Department must give prior approval for the return of any components or equipment.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation, and preventive maintenance.

If equipment service is required, please contact your local distributor or Thermo at (1-888-213-1790 in USA and Canada, or 1-740-373-4763). We're ready to answer your questions on equipment warranty, operation, maintenance, service, and special applications. Outside the USA, contact your local distributor for warranty information.



Appendix A

Handling Liquid Nitrogen



Contact of liquid nitrogen or cold gas with the skin or eyes may cause serious freezing (frostbite) injury.

Handle liquid nitrogen carefully.

The extremely low temperature can freeze human flesh very rapidly. When spilled on a surface the liquid tends to cover it completely and intimately, cooling a large area. The gas issuing from the liquid is also extremely cold. Delicate tissue, such as that of the eyes, can be damaged by an exposure to the cold gas which would be too brief to affect the skin of the hands or face.

Never allow any unprotected part of your body to touch objects cooled by liquid nitrogen.

Such objects may stick fast to the skin and tear the flesh when you attempt to free yourself. Use tongs to withdraw objects immersed in the liquid, and handle the object carefully.

Wear protective clothing.

Protect your eyes with a face shield or safety goggles (safety glasses without side shields do not give adequate protection). Always wear gloves when handling anything that is, or may have been, in immediate contact with liquid nitrogen. Insulated gloves are recommended, but heavy leather gloves may also be used. The gloves should fit loosely, so that they can be thrown off quickly if liquid should splash into them. When handling liquid in open containers, it is advisable to wear high-top shoes. Trousers (which should be cuffless if possible) should be worn outside the shoes.

Introduction

The safe handling and use of liquid nitrogen in cryogenic refrigerators and dewar flasks is largely a matter of knowing the potential hazards and using common-sense procedures based on that knowledge. There are two important properties of liquid nitrogen that present potential hazards:

1. It is extremely cold. At atmospheric pressure, liquid nitrogen boils at -320°F (-196°C).
2. Very small amounts of liquid vaporize into large amounts of gas. One liter of liquid nitrogen becomes 24.6cu. ft. (0.7ml) of gas.

The safety precautions in this booklet must be followed to avoid potential injury or damage which could result from these two characteristics. Do not attempt to handle liquid nitrogen until you read and fully understand the potential hazards, their consequences, and the related safety precautions. Keep this booklet handy for ready reference and review.

Note: Because argon is an inert gas whose physical properties are very similar to those of nitrogen, the precautions and safe practices for the handling and use of liquid argon are the same as those for liquid nitrogen.

Use only containers designed for low temperature liquids.

Cryogenic containers are specifically designed and made of materials that can withstand the rapid changes and extreme temperature differences encountered in working with liquid nitrogen. Even these special containers should be filled SLOWLY to minimize the internal stresses that occur when any material is cooled. Excessive internal stresses can damage the container.

Do not cover or plug the entrance opening of any liquid nitrogen refrigerator or dewar. Do not use any stopper or other device that would interfere with venting of gas.

These cryogenic liquid containers are generally designed to operate with little or no internal pressure. Inadequate venting can result in excessive gas pressure which could damage or burst the container. Use only the loose-fitting necktube core supplied or one of the approved accessories for closing the necktube. Check the unit periodically to be sure that venting is not restricted by accumulated ice or frost.

Use proper transfer equipment.

Use a phase separator or special filling funnel to prevent splashing and spilling when transferring liquid nitrogen into or from a dewar or refrigerator. The top of the funnel should be partly covered to reduce splashing. Use only small, easily-handled dewars for pouring liquid. For the larger, heavier containers, use a cryogenic liquid withdrawal device to transfer liquid from one container to another. Be sure to follow instructions supplied with the withdrawal device. When liquid cylinders or other large storage containers are used for filling, follow the instructions supplied with those units and their accessories.

Do not overfill containers.

Filling above the bottom of the necktube (or specified maximum level) can result in overflow and spillage of liquid when the necktube core or cover is placed in the opening.

Never use hollow rods or tubes as dipsticks.

When a warm tube is inserted into liquid nitrogen, liquid will spout from the top of the tube due to gasification and rapid expansion of liquid inside the tube.



Nitrogen Gas Can Cause Suffocation Without Warning!

Store and use liquid nitrogen only in a well-ventilated place.

As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of nitrogen gas reduce the concentration of oxygen and can result in asphyxiation. Because nitrogen gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 18% oxygen can cause dizziness and quickly result in unconsciousness and death.

Note: The cloudy vapor that appears when liquid nitrogen is exposed to the air is condensed moisture; not the gas itself. The issuing gas is invisible.

Never dispose of liquid nitrogen in confined areas or places where others may enter.

Disposal of liquid nitrogen should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on pavement.

Appendix B

Handling Liquid CO₂



High concentrations of CO₂ gas can cause asphyxiation! OSHA Standards specify that employee exposure to carbon dioxide in any eight-hour shift of a 40-hour work week shall not exceed the eight-hour time weighted average of 5000 PPM (0.5% CO₂). The short term exposure limit for 15 minutes or less is 30,000 PPM (3% CO₂). Carbon dioxide monitors are recommended for confined areas where concentrations of carbon dioxide gas can accumulate.

Store and use liquid CO₂ only in a well-ventilated place.

As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of CO₂ gas reduce the concentration of oxygen and can result in asphyxiation. Because CO₂ gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 18% oxygen can cause dizziness and quickly result in unconsciousness and death.

Note: The cloudy vapor that appears when liquid CO₂ is exposed to the air is condensed moisture; not the gas itself. The issuing gas is invisible.

Never dispose of liquid CO₂ in confined areas or places where others may enter.

Disposal of liquid CO₂ should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on pavement.

First Aid

If a person seems to become dizzy or loses consciousness while working with liquid nitrogen or carbon dioxide, move to a well-ventilated area immediately. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen. Call a physician. Keep warm and at rest.

If exposed to liquid or cold gas, restore tissue to normal body temperature (98.6° F) as rapidly as possible, followed by protection of the injured tissue from further damage and infection. Remove or loosen clothing that may constrict blood circulation to the frozen area. Call a physician. Rapid warming of the affected part is best achieved by using water at 108° F. Under no circumstance should the water be over 112° F, nor should the frozen part be rubbed either before or after rewarming. The patient should neither smoke nor drink alcohol.

Declaration of Conformity

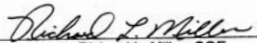
Manufacturer's Name: Thermo Electron Corp.
Manufacturer's Address: 401 Millcreek Road
Marietta, Ohio 45750
U.S.A.
Product Description: Forma® Laboratory Freezer
Product Designations: 722
Year of Initial CÉ Marking: 2003
Affected Serial Numbers: Release 3
(Release Level [REL#] shown on Serial Tag)

This product conforms to the following European Union Directive(s):

EMC: 89/336/EEC
LVD: 73/23/EEC

This product conforms to the following Harmonized, International and National Standards:

EMC:	LVD:
EN 61326-1:1997	EN 61010-1
EN 50081-1:92	Amendments 1 and 2
EN 50082-1:97	EN 60335-2-24 (applicable sections)
	CSA C22.2 No. 1010.1
	UL 471 (applicable sections)
	UL 61010A-1


Richard L. Miller, CQE
Regulatory Compliance Manager

Thermo
ELECTRON CORPORATION

30 November 2004

Rev. 3

Declaration of Conformity


Manufacturer's Name: Thermo Electron Corp.
Manufacturer's Address: 401 Millcreek Road
Marietta, Ohio 45750
U.S.A.
Product Description: Forma® Laboratory Freezer
Product Designations: 727
Year of Initial CÉ Marking: 2003
Affected Serial Numbers: Release 3
(Release Level [REL#] shown on Serial Tag)

This product conforms to the following European Union Directive(s):

EMC: 89/336/EEC
LVD: 73/23/EEC

This product conforms to the following Harmonized, International and National Standards:

EMC:	LVD:
EN 61326-1:1997	EN 61010-1
EN 50081-1:92	Amendments 1 and 2
EN 50082-1:97	EN 60335-2-24 (applicable sections)
	CSA C22.2 No. 1010.1
	UL 471 (applicable sections)
	UL 61010A-1


Richard L. Miller, CQE
Regulatory Compliance Manager

Thermo
ELECTRON CORPORATION

30 November 2004

Rev. 3

Declaration of Conformity

Manufacturer's Name: Thermo Electron Corp.
Manufacturer's Address: 401 Millcreek Road
Marietta, Ohio 45750
U.S.A.
Product Description: Forma® Laboratory Freezer
Product Designations: 728
Year of Initial CÉ Marking: 2003
Affected Serial Numbers: Release 3
(Release level shown on Serial Tag)

This product conforms to the following European Union Directive(s):

EMC: 89/336/EEC
LVD: 73/23/EEC

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Declaration of Conformity

Manufacturer's Name: Thermo Electron Corp.
Manufacturer's Address: 401 Millcreek Road
Marietta, Ohio 45750
U.S.A.
Product Description: Forma® Laboratory Freezer
Product Designations: 729
Year of Initial CÉ Marking: 2003
Affected Serial Numbers: Release 3
(Release level shown on Serial Tag)

This product conforms to the following European Union Directive(s):

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LVD: 73/23/EEC

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